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MARINE GRAVITY DISCREPANCIES
IN THE SOLOMON ISLANDS

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IN THE SOLOMON ISLANDS

by

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ABSTRACT

In 1964 a reconnaissance marine gravity survey was conducted in the Solomon Islands by the Hawaii Institute of Geophysics, University of Hawaii. In 1965 a more detailed survey was conducted in the same area by the same investigators. In one particular area of the survey, gravity anomalies obtained in 1964 differed from those obtained in 1965 by as much as 168 milligals. In other areas where differences did occur, these were on the order of 25 milligals. This thesis reports the investigation carried out to determine the reason or reasons for the large discrepancies. Navigational positions were checked; the bathymetry obtained in 1964 was compared with other bathymetry available; the Eötvös correction was recalculated with the corrected station position and better resolution; and the gravity records were examined to determine if large vertical accelerations of the measuring platform could be the cause of the discrepancies. Some errors were discovered, but the large differences could not be eliminated.

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CHAPTER I

INTRODUCTION

1. MEASUREMENTS OF GRAVITY AT SEA

Reasons

Gravity is measured for a number of reasons, and the results can be used by different branches of the scientific field. For the geologist, gravity anomalies can help in his interpretation of the geological structure of the earth in a particular area; for those interested in geodesy, gravity anomalies aid in determining the shape of the geoid; for the geophysicist engaged in petroleum exploration, the measurement of gravity has proved to be a valuable tool for reconnaissance exploration.

Anomalies and Corrections

For gravity measured on land, corrections must be applied to observed gravity in order to reduce it to the value which would be observed on a perfectly uniform spheroid. This spheroid is completely smooth with the vertical distribution of density everywhere the same. The free-air correction is applied to correct the observed gravity to that which would be observed at sea level. It is a positive correction for gravity observations made above sea level. The Bouguer correction takes into account the attraction of the rock material between sea level and the position at which gravity is measured at some elevation above sea level. It is a negative correction in that it is designed to remove the rock material between the gravity

station and sea level. The topographic correction takes into account the attraction of any material higher than the gravity station and of material which would be needed to fill any hollows below in order to construct a level earth. (Dobrin, 1960). The topographic correction is always added to the observed gravity. There is still another correction, the isostatic correction, which may be applied; it usually is omitted.

At sea, the correction to observed values is somewhat different. Since measurements at sea are made essentially at sea level, the free-air correction is trivial and not made. (Worzel and Harrison, 1963). The observed gravity value is corrected only for the effect of the Coriolis force due to the vessel's motion on the rotating earth. This Eötvös correction is determined by the equation:

$$(1) \delta g = 7.487 S \sin C \cos \phi + (S^2/240.8)$$

where C is the true course made good, ϕ the latitude and S the east-west component of ship's motion. (Worzel and Harrison, 1963). It is additive for an easterly course and subtractive for a westerly one. Although the Eötvös correction is mentioned in connection with gravity measurements made at sea, this correction should be applied to measurements made from any moving platform. There is also a term in the Eötvös correction which accounts for motion in a north-south direction, but this involves less than one milligal change in observed gravity for platform speeds of

less than 16 knots and has been omitted in Equation (1). The value of gravity at sea-level for the latitude of the observation is determined by the International Gravity Formula:

$$(2) \ g = g_E (1 + \beta \sin^2 \phi + \epsilon \sin^2 2\phi) \text{ CM/SEC}^2$$

where g is the value of gravity at any point of the surface of the reference spheroid, g_E (978.0490) its value at the equator, ϕ the latitude, and β (0.0052884) and ϵ (-0.0000059) are constants. (Heiskanen and Vening Meinesz, 1958). The sea free-air gravity anomaly is the difference between the gravity measurement and the value of gravity computed from equation (2). It is expressed in milligals (1 mgal = 0.001 cm/sec²).

Free-air anomalies result from a difference in the distribution of masses on the real earth and the distribution assumed for the reference spheroid. Small-scale variations at sea are often closely related to the change in depth of water. These variations may have to be removed before other features, beside the ocean bottom topography, can be examined. A method for removing the effect of the lower density of sea water is to correct the measured gravity for the density contrast between the water and appropriate rock material. This correction is added to the free-air anomaly and the resulting anomaly is the Bouguer anomaly. According to Worzel and Harrison (1963), the gravity anomaly profile will show no correlation with bottom topography if the correct density is chosen,

and if there is no sub-bottom compensation.

Vening Meinesz (Heiskanen and Vening Meinesz, 1958) examined several sea gravity stations at random and pointed out that the Bouguer anomalies increased strongly in a positive sense with increasing depth. Averaging the depths and anomalies at six stations, he computed the Bouguer anomaly which should exist for the average depth if the oceans were in complete isostatic equilibrium. The difference between the computed and the average anomaly was ten milligals which led him to conclude that isostatic equilibrium prevails at sea.

2. HISTORY OF GRAVITY MEASUREMENTS IN THE SOLOMONS

Grover (1966) has summarized the gravity surveys which have been conducted in the Solomons, and this discussion will not attempt to do more than mention briefly what he has said. Figure 1 shows the Solomon Islands with the names of the major islands appearing.

Planned Expeditions

The idea of a gravity survey of the island chain first came up in 1949, and a survey was later planned for 1951. Also, Woollard of the University of Wisconsin World Gravity Project scheduled a visit to the islands in 1951 to tie the gravity of the airfields to the world gravity network; however, neither his visit nor the survey took place.

Initial Surveys and Proposal

One British and two United States submarines made

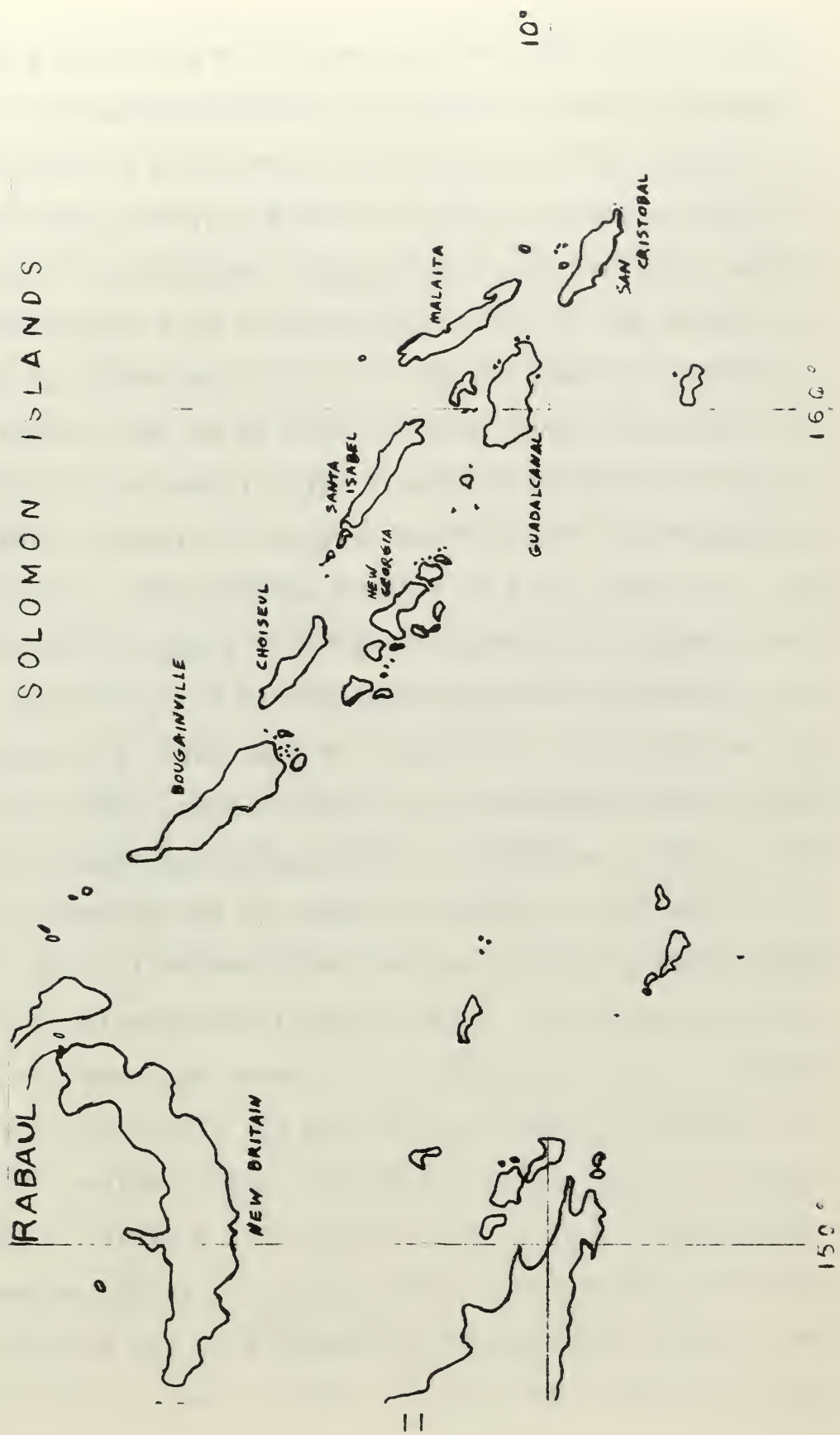


Fig. 1. The Solomon chain with the names of the major islands shown.

gravity surveys in the region but did not provide any information useful in the study of the Solomons. In 1960 Oil Search Limited of Australia conducted a gravity survey of the Guadalcanal plains and made coastline and offshore island observations. The Bouguer anomalies indicated that the basin was divided into two parts by a gravity-high extending northward from a ridge in the center of Guadalcanal to the coast. What were believed to be the steepest gravity gradients known in the world were discovered. Economic accumulations of petroleum were not indicated, however, and the company did no further survey work. In 1961 a representative of the University of Wisconsin World Gravity Project made gravity observations at all airfields in the Solomon Islands. In October of that year, a proposal was made by the Geophysical and Polar Research Center of the University of Wisconsin to the National Science Foundation for a gravity and magnetic survey of the Solomon Islands, New Britain, New Guinea, and the Bismarck Islands. Woollard mentioned in the proposal that knowledge of the ~~earth's~~ crustal structure in this area was based on hypothesis. In a separate paper, Woollard et al. (1967) noted that as a result of analysis of the orbital perturbations of the first earth-orbiting artificial satellites, a marked bulge in the geoid was discovered. This bulge, indicating excess gravity, had a center corresponding roughly with the Solomon Islands. When electronic and optical tracking data of additional

satellites was analyzed, it was proposed that the Solomon Islands region was the area of the Earth having a maximum anomalous mass. The cause of this mass effect could not be determined. Was it related to the core of the earth, or was it the integrated effect of many small, near-surface mass inhomogeneities of crustal and upper mantle origin? The little information which was available seemed to increase the interest in a detailed survey. The proposal was approved and a land survey of the Solomons began in March, 1963. About 2,000 gravity stations were occupied from this date until January, 1964.

The HMS COOK was originally scheduled for the sea gravity phase of the regional study, but an uncharted pinnacle prevented her from conducting the sea survey planned for 1964. On short notice, the USS WANDANK (ATA 204) was made available for the month of November, 1964, and was used for two weeks in the region collecting data. The HMS DAMPIER was later made available for an October-December 1965 survey.

CHAPTER II

THE WANDANK CRUISE

This chapter was written to present the ship and the scientific party and to discuss the equipment used, the significant events of the cruise, and to lay a foundation for the remainder of the thesis.

1. THE WANDANK AND THE SCIENTIFIC PARTY

The WANDANK is an auxiliary ocean-going tug with a displacement of 850 tons, a beam of 33 feet, and a length of 143 feet. The main deck has a large working area aft, but it is normally awash in other than extremely calm conditions. There is limited working space on the weather deck immediately above the main deck. The ship, being diesel powered, has a long cruising range; so, from this standpoint, she was ideally suited to make the 1300 mile voyage from her homeport in Guam, Mariana Islands, to the Solomons.

The scientific party aboard consisted of Rose and Ichinose of the Hawaii Institute of Geophysics and Maples of the Naval Oceanographic Office; Rose served as chief scientist. The author was Commanding Officer of the WANDANK.

2. EQUIPMENT USED IN SURVEY

Gravimeter

A LaCoste-Romberg air-sea gravity meter, S2A, was made available by the Office of Naval Research. A simple schematic

of this gimbal suspended instrument appears in Figure 2. The effects of vertical accelerations due to ship motion are filtered out by means of a low pass filter. In this meter, horizontal accelerations are allowed to swing the meter. " The sensitive axis, OA, of the meter is then aligned in the direction of the vector sum of gravity and the horizontal acceleration, and the meter measures this vector sum." (LaCoste-Romberg, p.5) This apparent gravity differs from actual gravity by the Browne Correction

$$(3) \quad a_h = (\text{CONSTANT}) \theta^2$$

where θ is the angle between the vertical and the sensitive axis. (LaCoste-Romberg). The horizontal accelerometers provide a stabilized reference system in space to permit determination of this angle. An analog computer calculates the Browne Correction and subtracts it from the indication of the Gravity Meter Unit. The sensitive element or beam is hinged at O and the other end is supported by a "zero length spring", the tension being varied by means of the measuring screw. By use of the spring, the behavior of the beam is made independent of its position in the gravity meter. The force exerted by the spring is proportional to its length and is represented by a vector AB equal to its length. When the gravity meter is in equilibrium with gravity, the vector forces at B form a closed triangle. AB represents the spring force; OB represents the force

exerted by the beam at B; and AO represents gravity. The velocity of the beam is used to measure the difference between gravity and the length of the vector OB, defined as the spring tension, S.

$$(4) \ g = S - K \frac{dB}{dt}$$

where B is the beam position, K is a constant and t is time (LaCoste-Romberg). If the vertical accelerations associated with the movement of the platform are filtered out, the equation becomes:

$$(5) \ \bar{g} = \bar{S} - K \frac{d\bar{B}}{dt}$$

where the bars denote filtering or averaging. At this time the correction for horizontal accelerations is made by subtraction from S, which results in the correction to

\bar{g} . The beam position and the averaged or filtered beam position are recorded on the beam position recorder. The beam is kept positioned near its center by adjustment of the spring tension by use of a knob on the counter unit. The knob is connected by synchros to the measuring screw. The record of \bar{B} is differentiated graphically in order to obtain \bar{g} from equation (5). Laboratory tests indicate an accuracy of \pm one milligal for horizontal and vertical accelerations less than thirty gals (30 cm/sec^2) and an accuracy of \pm two milligals for accelerations less than fifty gals (LaCoste-Romberg).

Other Equipment

A Varian Associates transistorized, marine model,

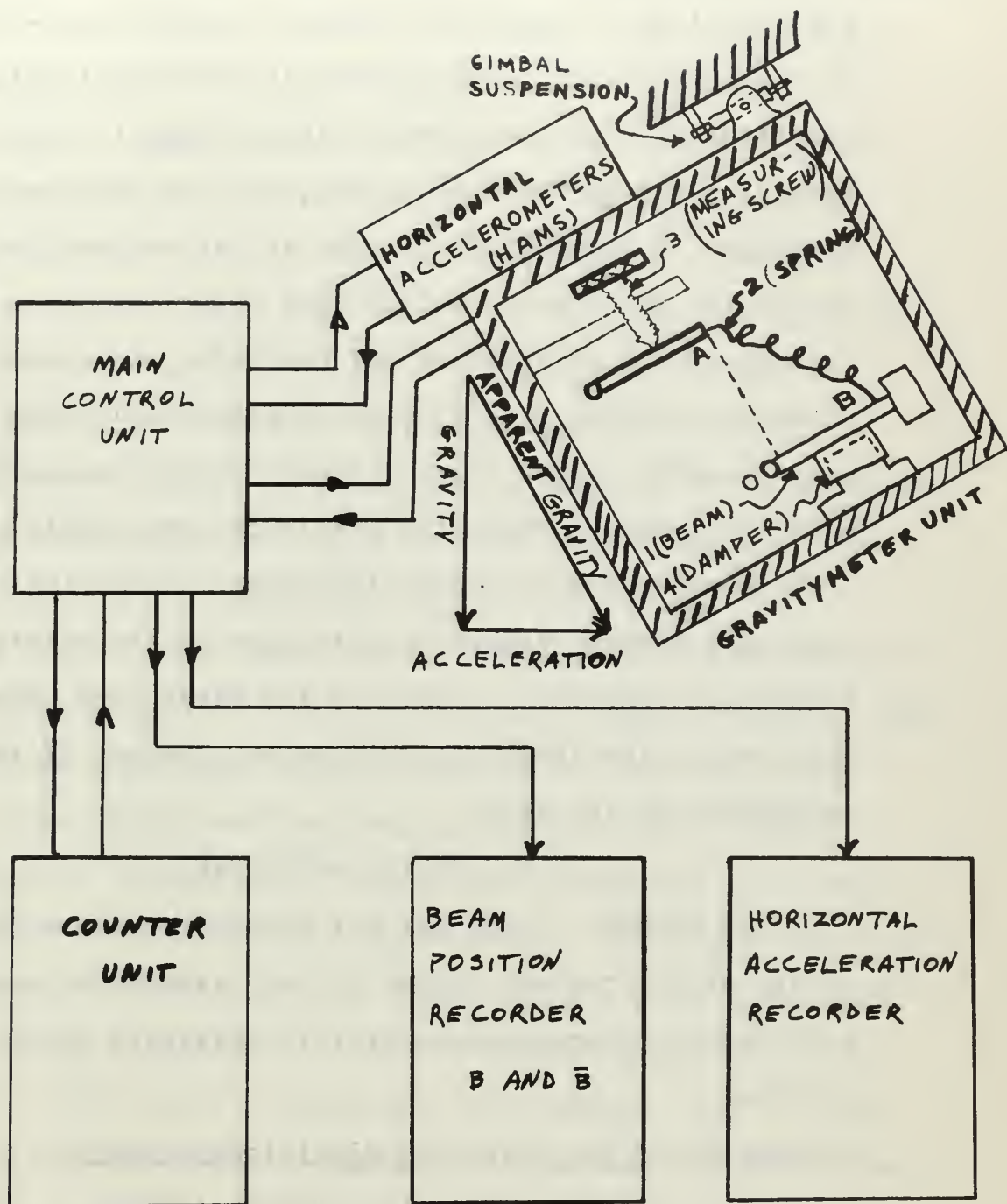


Fig. 2 Block diagram of LaCoste-Romberg air-sea gravity meter (after LaCoste-Romberg).

proton-precession magnetometer was aboard for the cruise, but it failed to function properly. A McKiernan-Terry Mark XV precision depth recorder was also made available. A representative of the company flew to Guam in hopes of observing its performance at sea, but the recorder was misplaced in transit and did not arrive on Guam until after the cruise had begun. Depths were determined by a UQN-1 fathometer. A portable diesel generator was placed on the uppermost weather deck to provide electrical power for the gravity meter, and a small air conditioner was used to cool the space in which the gravimeter was located. The gravity meter and air conditioner were placed inside a temporary plywood "shack" constructed in the crew's berthing compartment located on the first deck below the main deck. The location is above and forward of the metacenter of the ship.

3. CRUISE NARRATIVE

The WANDANK cruise was not intended to be a detailed survey of the region; rather it was designed to establish a series of reconnaissance gravity traverses around the islands.

Discussion of the Track and Significant Events

On 31 October, 1964, the WANDANK left Guam on the first leg of the cruise. It was planned to operate the gravity meter throughout the entire cruise, but sea conditions prevented the measurement of gravity until the ship

approached New Ireland on the 5th of November. However, a land gravity measurement was made at Truk, Caroline Islands, during a brief stop there on 2 November. The ship stopped in Rabaul, New Britain, on the 6th where it refueled, and land gravity measurements were made at the gravity station at the airport and at the main wharf. The base gravity value for the cruise was the Potsdam value of gravity at the main wharf. This was transferred by land gravity meter from the international value at the airport. It was later determined from closures at reoccupations at Honiara, Guadalcanal, Rabaul, and Guam that a negative drift occurred during the cruise; and a 2.0 milligal correction was added to the base value to account for this drift.

The ship left Rabaul on the 6th and began the survey of the northern part of the Solomons chain about midnight. Sea conditions were ideal and remained so for about the next week. The ship's surface search radar, however, became inoperative shortly after the survey began; and this caused some modification of the planned track. The exact date that the radar failed is not now known, but the ship's log shows that it was inoperative on the 12th (Quartermaster's Notebook). There was no replacement part aboard, and the radar remained inoperative throughout the remainder of the cruise. On the night of the 11th of November, the ship encountered a swell running from the northeast which, striking the port beam of the ship, prevented data collection on a southeast

course. On the 12th, when the ship turned to the west to survey the southern side of the Solomons chain, a modification of the proposed track was made. In order to pass through a particular area in the time allotted and to measure gravity while doing it, the ship slowed to about 8 knots, steamed in a southwesterly direction with the swell following and made gravity measurements for about one and one-half hours. Then the ship increased speed to about 11 knots and steamed in a westerly or northwesterly direction for about one hour. No gravity measurements could be made except when the ship was running with the swell. The above procedure allowed the ship to make good the desired advance and to collect gravity. On the 13th, when the ship was within the lee of San Cristobal Island, she was able to return to her proposed track. On the 15th, a stop was made at Honiara, Guadalcanal, to allow Rose to confer with representatives of the Department of Geological Surveys, British Solomon Islands. It was originally planned to make this a brief stop and then to make a roundtrip transit of The Slot. Without the use of the radar, and because of the lack of navigational aids, a transit of The Slot in other than daylight conditions was ruled too dangerous, and this plan was canceled. In Honiara, Rose learned that the area of Sealark Channel and Lengo Channel might prove interesting from a gravity standpoint; the ship remained in Honiara overnight in order to transit this new area on the morning of the 16th.

The remainder of the cruise was carried out as planned. An overnight stop was made on the 20th of November in Rabaul where the ship refueled and took on fresh provisions. The return to Guam was along a different track as the ship passed west of New Ireland rather than east. Sea conditions did not permit measurements to be made on the return trip. The ship arrived at Guam on the 26th of November. Figure 3 shows the track made good by the "ANDANK", and Figure 4 shows the lines of gravity data collected.

Navigation and its Accuracy

Celestial navigation was employed throughout most of the cruise. Under the best conditions, a celestial line of position can be considered accurate to within two miles on either side of the line. Such accuracy considers errors in altitude measurement only and does not allow for errors which might be introduced through mistakes in timing, computation of the line of position, or in plotting. Some lines of position might be more accurate and others less. When several lines of position are plotted to obtain a fix, it should be expected that some fixes might be in error by three or four miles (Hill II, Utegaard, and Riordan, 1958). Piloting or determining one's position by visual observation of prominent geographical features and/or aids to navigation was employed whenever possible. This method is much more accurate than celestial means, but the ship was seldom close enough to land to use it. Loran coverage of the region was not sufficient

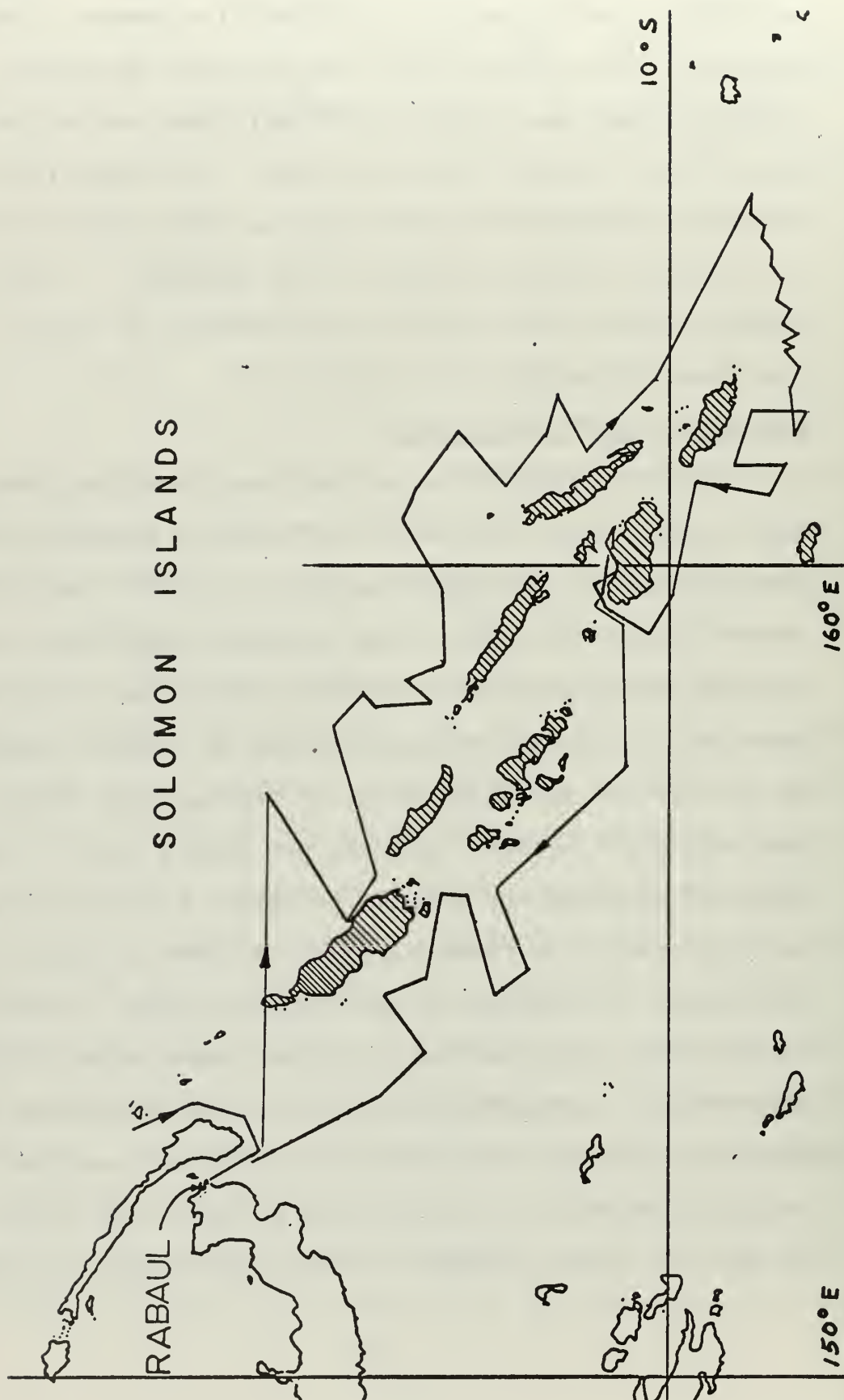


Fig. 3. The track of the USS "ANDANK" (ATA 204) during gravity survey in November, 1967. (after Rose, 1967)

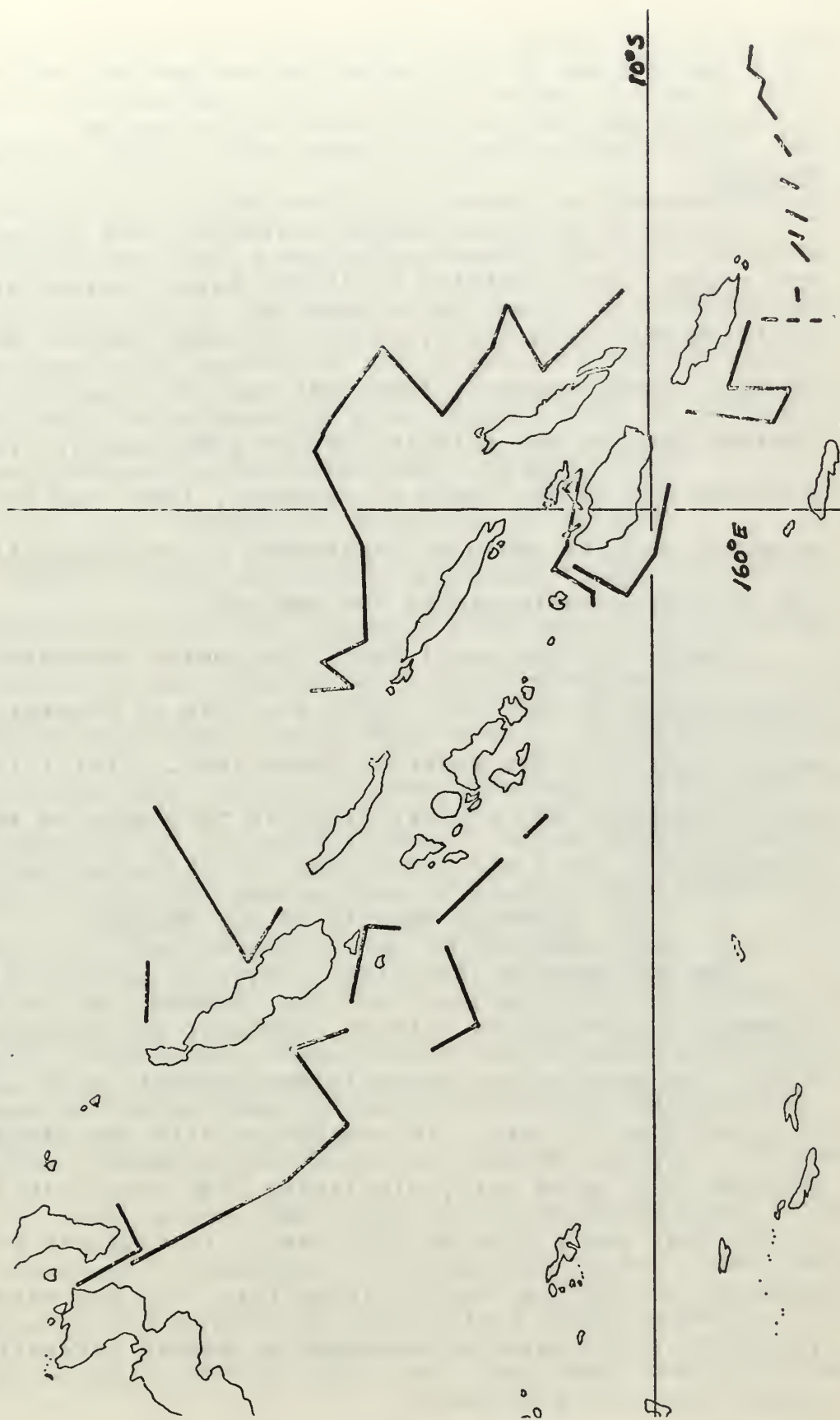


Fig. 4. Gravity tracks made good during 1964 survey.
(after Rose, 1967)

to allow the use of this method of navigation, and radar navigation was not possible much of the cruise.

Weather

The ship collected synoptic weather data throughout the cruise and submitted it to the Naval Weather Service, Environmental Detachment, at the National Weather Records Center. Unfortunately, this data was not retained; the Naval Weather Service was able to furnish some reports from the Solomons during the month of November, 1964, but only nine synoptic reports could be considered as representative of the weather experienced by the WANDANK.

Except for the swell conditions which disrupted gravity measurements on the 11th, 12th, and 13th of November, the sea and swell seldom exceeded three feet. Visibility was good throughout the cruise; very few rain squalls were encountered; and a wind exceeding ten knots was rare.

4. REPORTED RESULTS OF ALL CRUISES

The HMS DAMPIER conducted a detailed survey of the Solomon Islands during October, November and December of 1965. Sea gravity and magnetic measurements were made from this modified frigate. In comparison with the WANDANK, the DAMPIER is a large ship, displacing 2230 tons with a length of 307 feet and a beam of 38.5 feet. In November and December of 1966, a team of scientists from the Hawaii Institute of Geophysics conducted a seismic refraction expedition in the Solomons.

The results of the gravity and magnetic studies made in the Solomons have been reported (Rose, Woollard, and Malahoff, 1967). This report included a preliminary map of the bathymetry of the region, free-air and Bouguer gravity anomaly charts, and a magnetic anomaly chart. Preliminary interpretations of the gravity and magnetic findings have been made. The results of the seismic refraction expedition, while considered in this report, were the subject of a separate publication (Woollard, et al., 1967).

5. PURPOSE OF REMAINDER OF THESIS

After reading the above paragraph concerning the reporting of the results obtained from the various cruises conducted by the Hawaii Institute of Geophysics, one might question why another paper was needed. Although the WANDANK cruise was meant only as a reconnaissance cruise, much data was obtained at no small expense. Aside from the bathymetric data obtained and one section of gravity data (that collected along the track perpendicular to Bougainville), the only use made of the WANDANK data was that mentioned by Grover. He stated, "the usable results were sufficiently conclusive to remove all objections to the provision of funds by the National Science Foundation for further survey." (Grover, 1966). This is not meant as a criticism of Rose and others at the Hawaii Institute of Geophysics, as he in particular was extremely helpful in making this paper possible. So much data was available to them, that they used that which seemed

most accurate and which best fitted their needs. It was felt that another look at the WANDANK data might be fruitful; any obvious discrepancies would be corrected and the data would be available in best possible form for others to use.

A second purpose of the paper and one related to the first, was to explain why, in one particular region, gravity anomalies obtained from WANDANK data and those obtained from DAMPIER data differed by about 150 milligals.

CHAPTER III

RESULTS OF THE WANDANK CRUISE

Free-air and Bouguer anomalies for the area of the Solomon Islands covered by the WANDANK were examined. Correlations of the anomalies with depth and latitude, and trends with each other and depth were produced by use of computer programs.

I. FREE-AIR, BOUGUER ANOMALY, AND DEPTH CORRELATIONS

In order to show the anomalies and how they vary with each other, and with depth, Figure 5 is presented. It represents a Hollerith field printout of results of the gravity data reduction program developed by Rose. This particular section of the ship's track is from the 11th of November. The columns at the top of the figure give the values plotted; FAA is the free-air anomaly in milligals; MNDBA is the Bouguer anomaly in milligals. The Bouguer anomaly was determined by correcting the observed gravity (corrected for ship's motion), using the density difference between basalt and seawater in an equation derived from Vening Meinesz, (Heiskanen and Vening Meinesz, 1958) which is basically:

$$(6) \Delta g = 0.04185 (\bar{\rho} - 1.027) d$$

where d is the depth in meters and $\bar{\rho}$ is the mean bulk density of the basalt column of depth d . $\bar{\rho}$ was determined by a linear

interpolation using a modified form of Moore's density vs. depth curve (Moore, 1965). Rose (1967) preferred a terminal density other than the one described by Moore. Although the results were not presented here, densities ranging from 2.30 g/cm^3 to 3.00 g/cm^3 taken in steps of $.05 \text{ g/cm}^3$ were also employed in the data reduction and Bouguer anomalies determined for each density value. Depths in Figure 5 are given in meters. D represents depth, F the free-air anomaly, and B the Bouguer anomaly. When neither the free-air nor the Bouguer anomalies were determined, they were assigned values of + 480 milligals. When only the Bouguer anomaly was not determined (because depth was not known), asterisks appear in the MNDBA column and no value of B was plotted. Zero depth means that no depth was obtained at that particular gravity station. The right hand section of the figure shows that the free-air anomaly increased with decreasing depth while the Bouguer anomaly decreased under the same conditions. This trend was not the only one observed in the data. Figure 6 which presents data collected on the 18th and 19th of November has trends which are in agreement with Figure 5. The middle section of Figure 7, which also presents data collected on the 19th as well as the 20th of November, shows that both the free-air and Bouguer anomalies increased with decreasing depth and decreased with increasing depth, the free-air anomaly doing so much more markedly. In the right hand section of Figure 7, the trends return to the

pattern indicated in Figure 5. What should the trends be? Would it have been accurate to eliminate some of the data for failure to follow standard trends? Figure 8 shows the gravity anomaly profiles across Seamount Jasper. The variations of the anomalies with depth is that of Figures 5 and 6. Worzel and Harrison (1963) stated that the most rapid variations of free-air anomaly are due to the changing effect of bottom topography, and that small-scale variations in the free-air anomaly are often closely related with changes in the depth of the water. Figure 9 shows the same trend of anomalies with depth as does Figure 8 for a different section of the ocean. In the case of Figure 8, Worzel and Harrison noted that 2.3 g/cm^3 is the correct density to use for rock substituted for sea water in determining the Bouguer anomaly, because such a density produces a profile which shows no correlation with bottom topography if there are no concealed masses. In this case, the rock of density 2.3 g/cm^3 eliminated the gravity effect of the seamount altogether. Figures 5 and 6 are examples where free-air anomaly and depth varied as expected, and the density used for determining the Bouguer anomaly was not the correct one to eliminate the effects of the topography. In the center section of Figure 7, the Bouguer anomaly was almost constant in the scale presented, and it may be that the density used for the column of basalt eliminated the topographic effects. The anomaly trend may also be due to the sub-crustal structure.

| DEPTH | MNDBA | FAA | TIME |
|-------|-------|------|------|
| 5047 | 227 | 0000 | 0000 |
| 5048 | 227 | 0000 | 0000 |
| 5049 | 227 | 0000 | 0000 |
| 5050 | 227 | 0000 | 0000 |
| 5051 | 227 | 0000 | 0000 |
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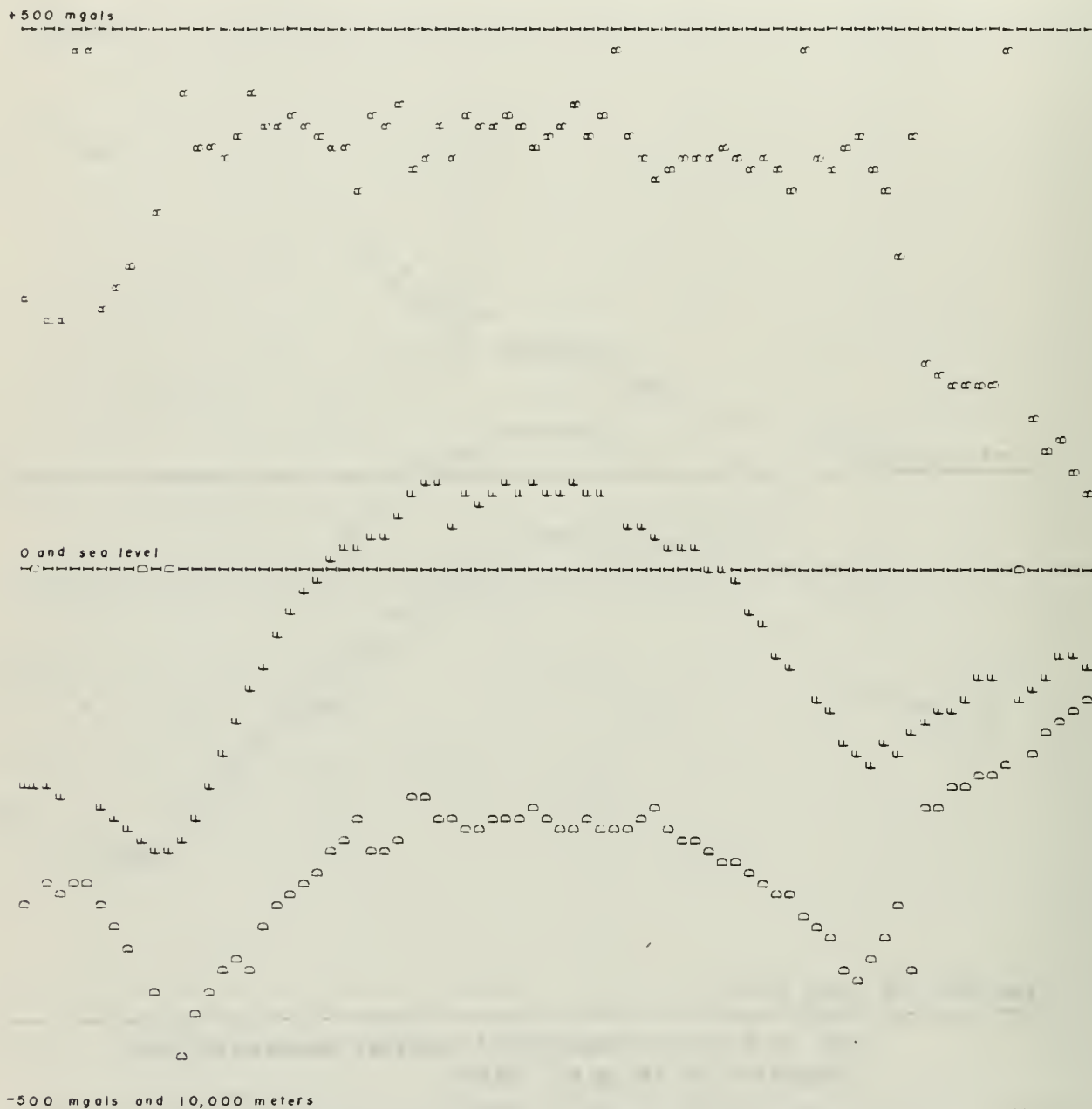


Fig. 7. Free-air anomaly (F), Bouguer anomaly (B), and depth (D) on 19-20 Nov 1964.

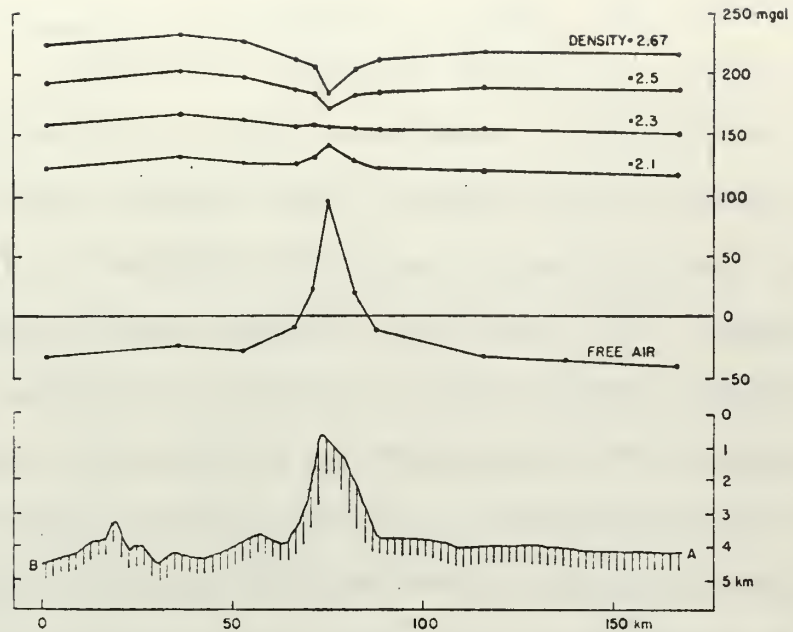


Fig. 8. Gravity-anomaly profiles across Seamount Jasper. (After Harrison and Brisbin, 1959)

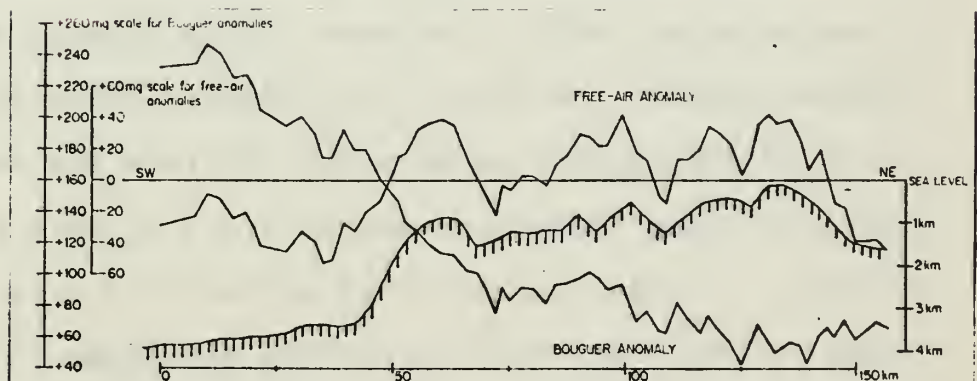


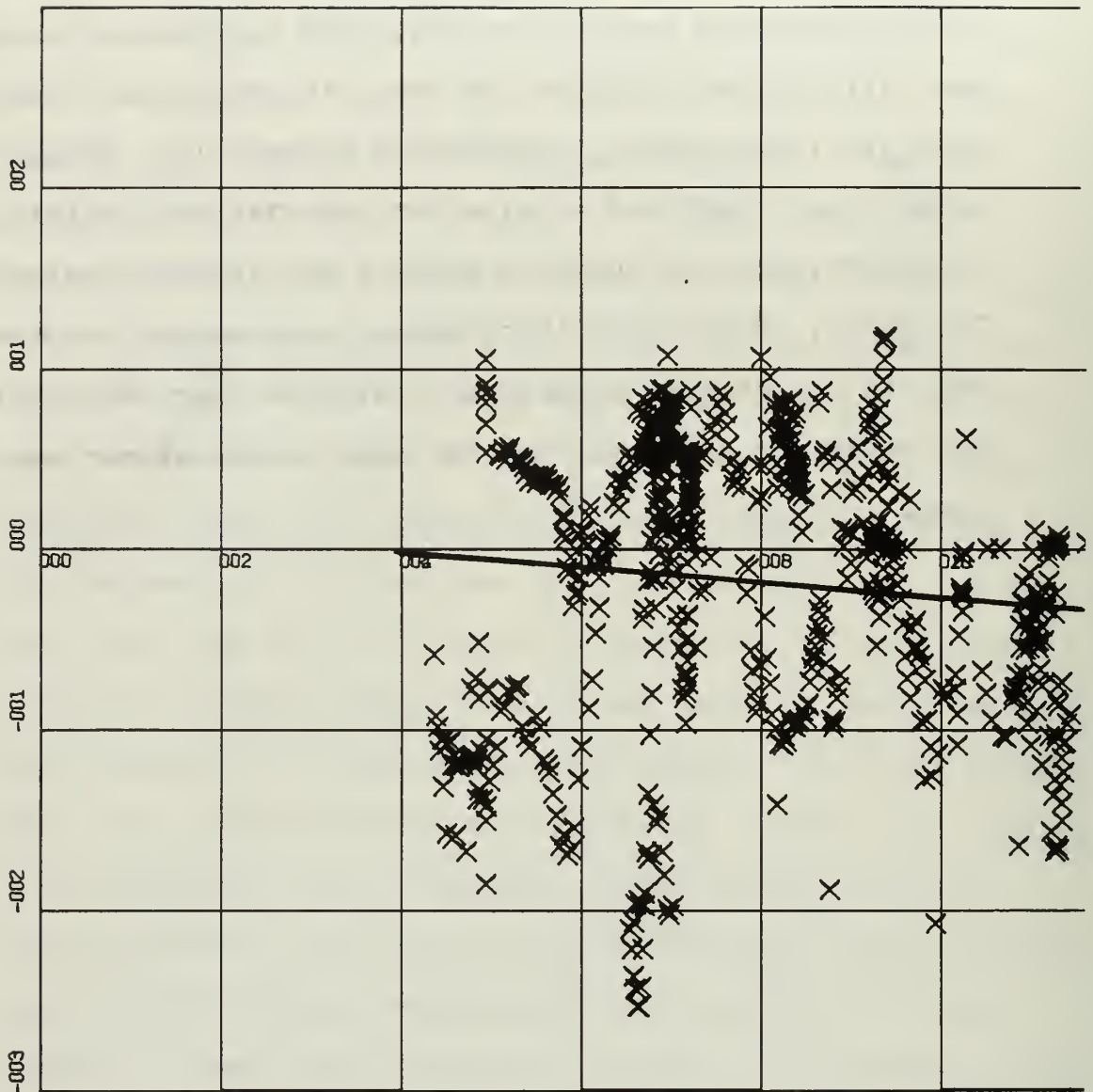
Fig. 9. Continental slope profile off Southern California. (After Harrison, 1959)

2. ANOMALIES CORRELATED SEPARATELY WITH LATITUDE AND DEPTH

Figures 10 through 14 (pp. -) were all constructed by computer subroutines. The x's mark the data points and the straight lines (on all but Figure 14) indicate a least squares fit to the data. Depths were plotted in meters, anomalies in milligals, latitude in degrees and tenths of degrees. The scales of the plots were printed at the bottom of the graphs. For example, in Figure 10, the x-scale was $2.00E + 00$ units per inch or 2 degrees of latitude per inch were plotted on the x-axis; the y-scale was $1.00E + 02$ units per inch or each inch represented 100 milligals. The grid superimposed on the graph was one inch by one inch. It was hoped that the plot of free-air anomaly vs. latitude shown in Figure 10 would reveal some strong trend in the anomaly with latitude. No such trend was present. Figure 11 shows that there was some trend of the free-air anomaly with depth, as was expected, with a decrease in the anomaly with increasing depth. The type of correlation to be expected from a plot of the Bouguer anomaly and latitude was not known. Figure 12 shows that there was no trend of this anomaly with latitude. It was expected that a trend did exist between the Bouguer anomaly and depth, and this was shown in Figure 13. No trends were evident nor expected in the plot of free-air anomaly and the Bouguer anomaly shown in Figure 14.

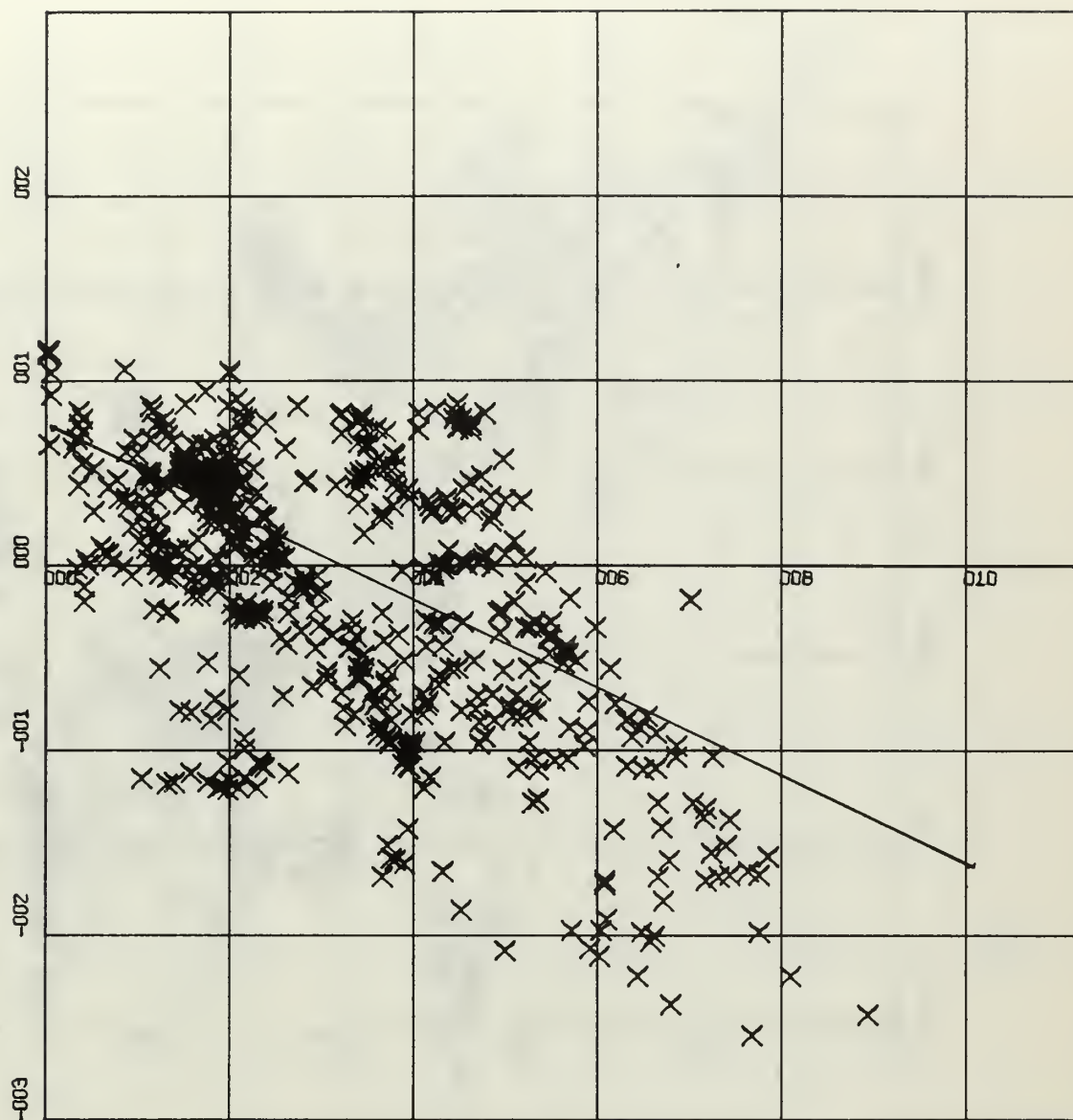
No significant improvement in fit was obtained by using

polynomials of higher degree than first. The computer subroutine determined the standard deviation of the data to serve as a goodness of fit parameter. Values of the goodness of fit parameter ranged from 105.17838 for Bouguer anomaly and latitude to 62.255325 for free-air anomaly and depth with the lower number indicating a better fit. Bouguer anomaly and depth had a value for the standard deviation of 62.473709, and the free-air anomaly and latitude value was 74.975922. Second and third degree polynomials did improve the fit for Bouguer anomaly and latitude from 105 to 91; but the magnitude of change for the other correlations was about four.



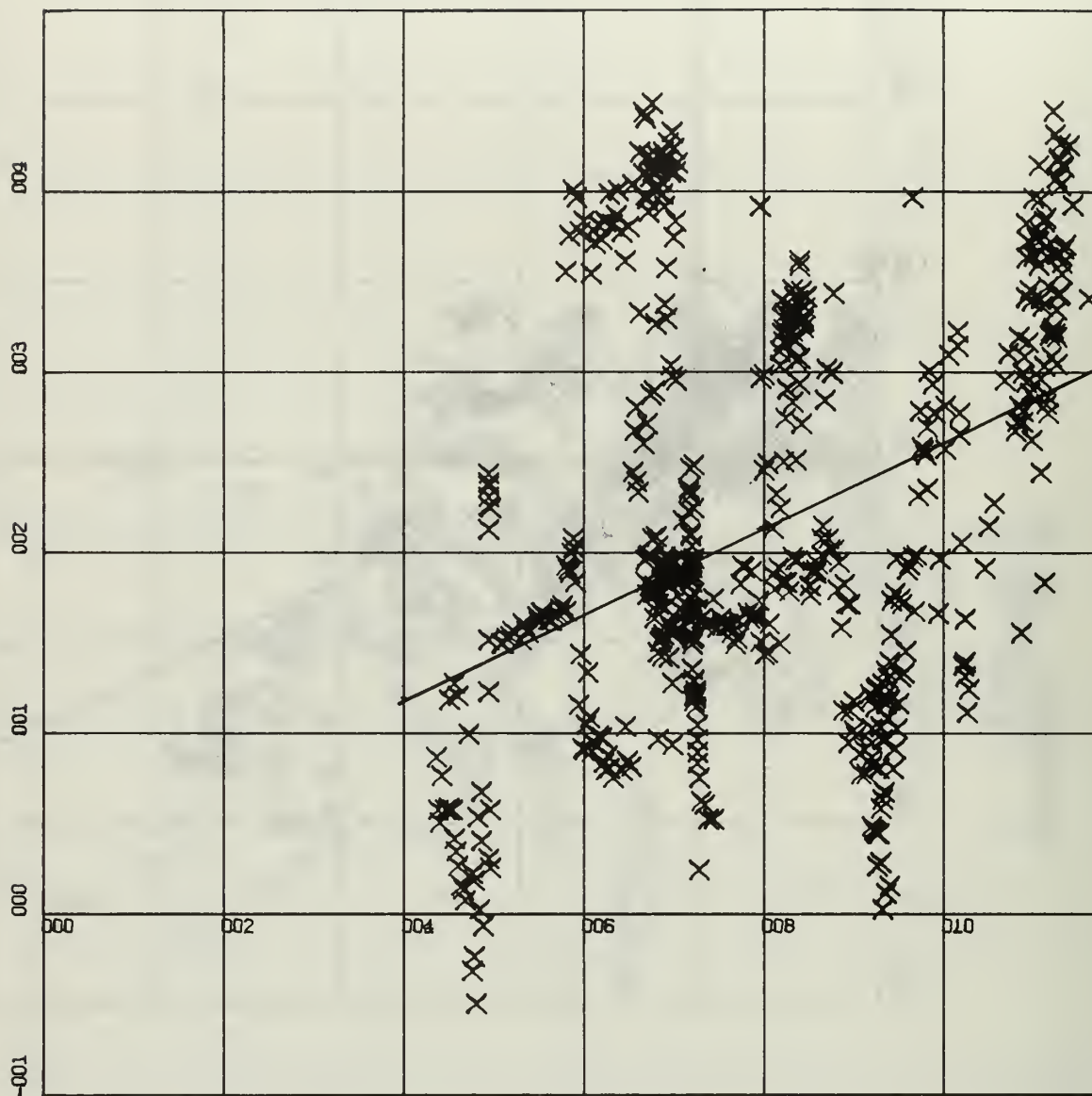
X-SCALE=2.00E+00 UNITS INCH.
Y-SCALE=1.00E+02 UNITS INCH.

Fig. 10. Free-air anomaly (Y-axis) vs. south latitude (X-axis) for Solomons region, 1964.



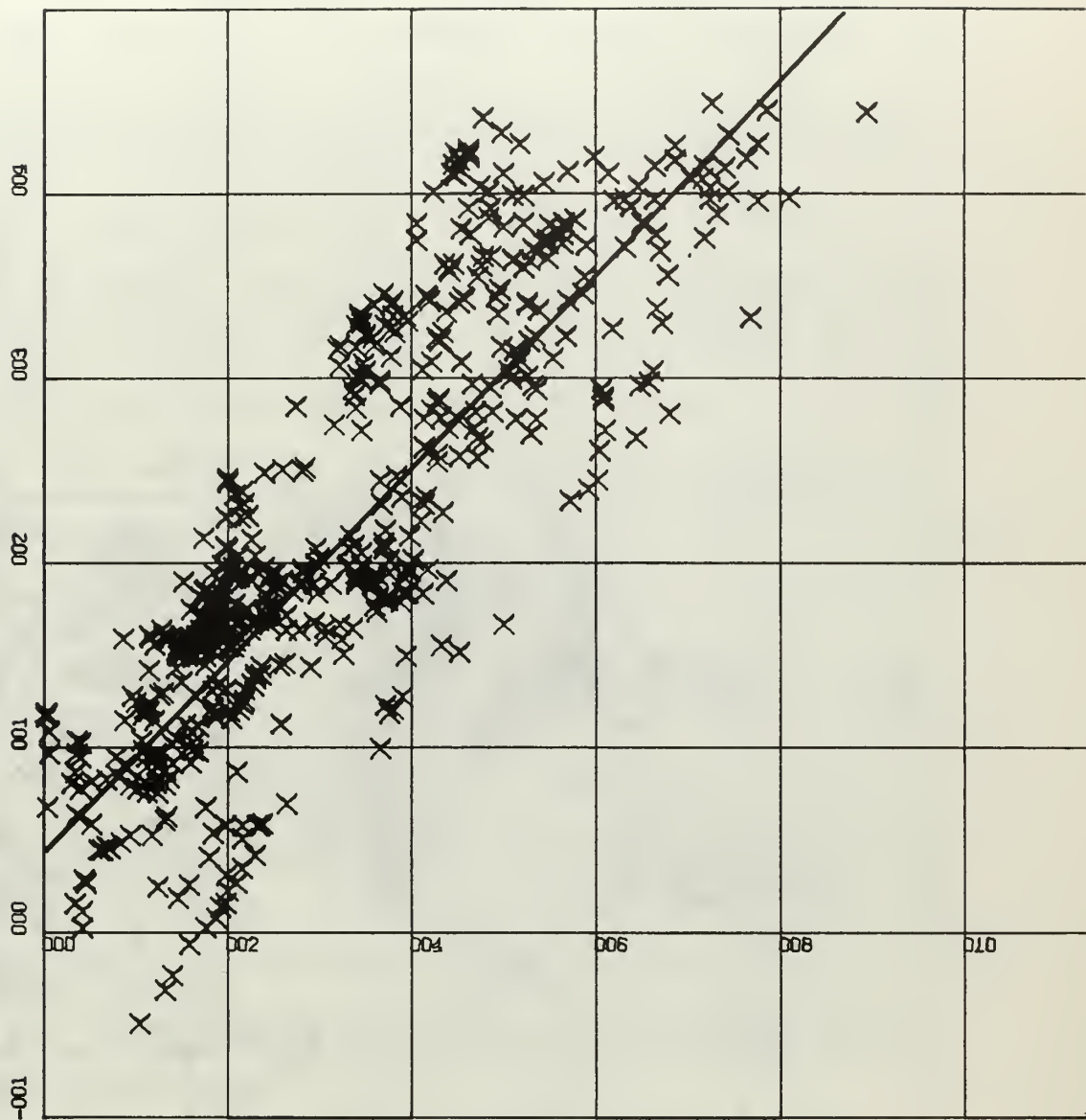
X-SCALE=2.00E+03 UNITS INCH.
Y-SCALE=1.00E+02 UNITS INCH.

Fig. 11. Free-air anomaly(Y-axis) vs. depth in meters
(X-axis) for Solomons region, 1964.



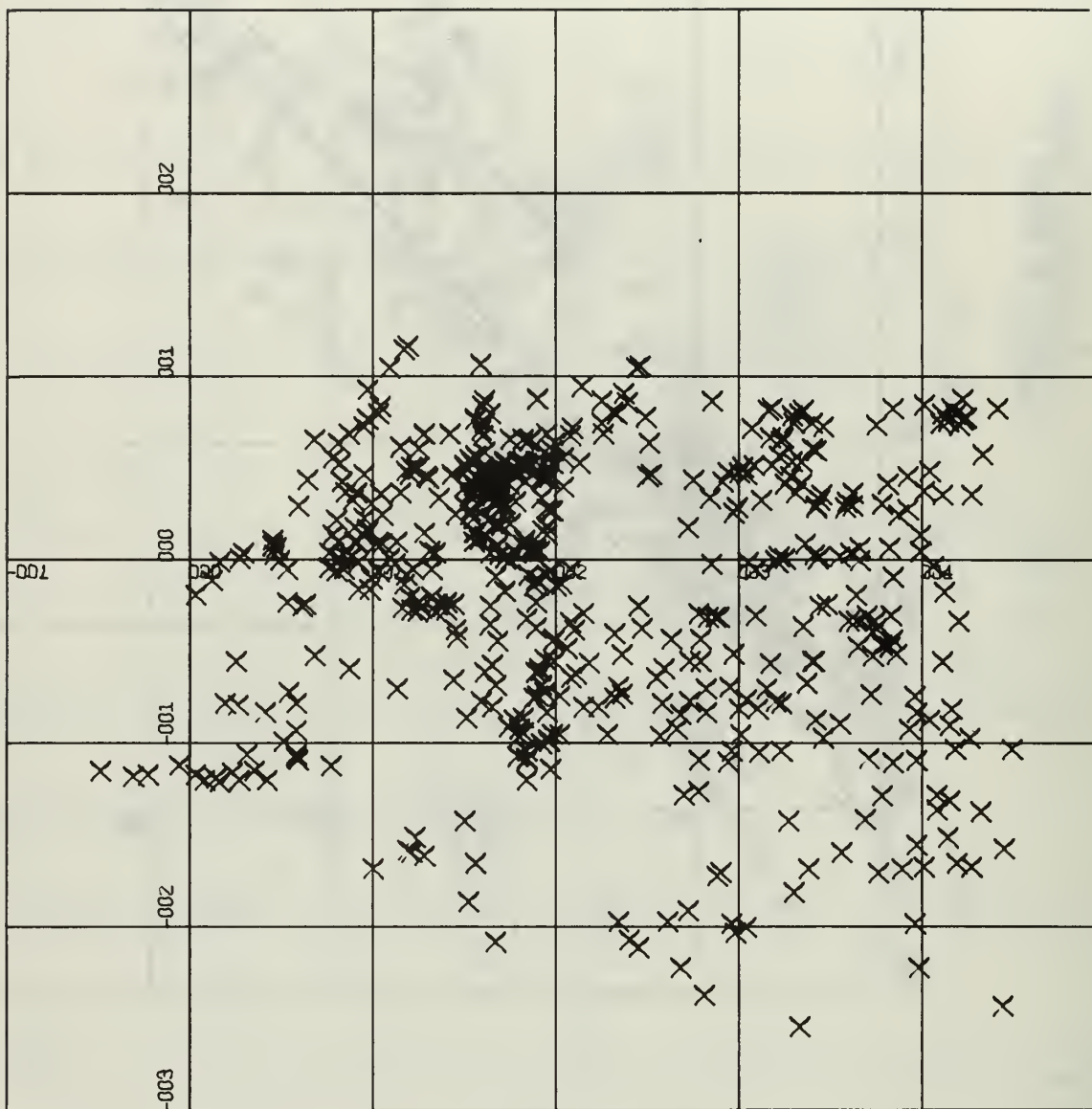
Y-SCALE=2.00E+00 UNITS INCH.
 Y-SCALE=1.00E+02 UNITS INCH.

Fig. 12. Bouguer anomaly(Y-axis) vs. south latitude
 (X-axis) for Solomons region, 1964.



X-SCALE=2.00E+03 UNITS INCH.
Y-SCALE=1.00E+02 UNITS INCH.

Fig. 13. Bouguer anomaly(Y-axis) vs. depth in meters (X-axis) for Solomons region, 1964.



X-SCALE=1.00E+02 UNITS INCH.
Y-SCALE=1.00E+02 UNITS INCH.

Fig. 14. Free-air anomaly(Y-axis) vs. Bouguer anomaly (X-axis) for Solomons regions, 1964.

CHAPTER IV

AREA OF DIFFERENCES BETWEEN WANDANK AND DAMPIER DATA

Data obtained by the DAMPIER and the WANDANK was not in complete agreement. WANDANK data collected on the 9th, 10th, and 11th of November resulted in anomalies which exceeded those computed from DAMPIER data by twenty to thirty milligals. Data from the WANDANK cruise during the three days following resulted in anomalies which were considered to be about 150 milligals too large. It was this latter time period, 12 - 14 November, which was examined more closely in an attempt to explain the data differences.

1. GEOGRAPHICAL AREA AND MAGNITUDE OF DIFFERENCES

The region where the greatest differences in data existed is shown in Figure 15. In this area there were six crossings of WANDANK and DAMPIER tracks and in sections where crossings did not occur, the tracks were separated by about 120 miles. The differences in anomalies in the sections of crossings were from 12 to 168 milligals for the free-air anomalies and from 22 to 132 milligals for the Bouguer anomalies.

2. POSSIBLE SOURCES OF ERROR IN WANDANK DATA

In order to determine the cause of such differences, it was assumed that the WANDANK data was in error; and an attempt was made to find where errors did or could exist and to correct, if possible, any errors found.

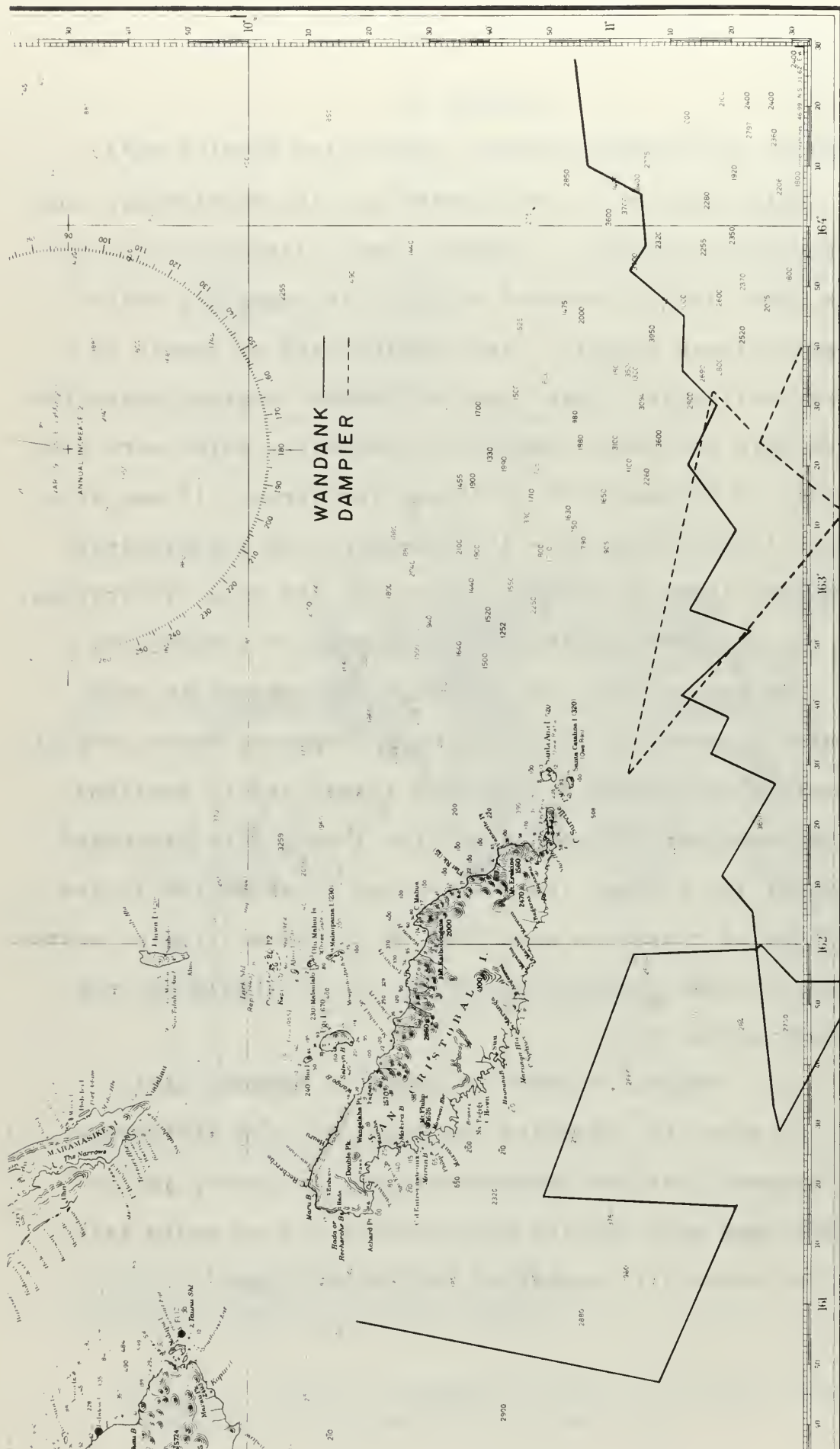


Fig. 15 WANDANK and DAMPIER tracks in area of anomaly differences.

Navigation Error

Navigation at sea, particularly by celestial means, is not as accurate as desired. The accuracy of such fixes was discussed in Chapter II. As an example of the effect that navigation can have on gravity anomalies, at a latitude of thirty degrees, a one mile error in position yields a one milligal error in an anomaly (Anderson, 1962). The entire track of the WANDANK was not replotted, because not all information required to do so was available; but the positions of each gravity station as given in the computer program were compared with those plotted on the corrected original navigational charts. Some positions were found to differ by as much as five miles. This comparison was made not only in the area under close scrutiny, but along the entire track. The original track had been corrected at some time after the cruise (all tracks shown are corrected), and it appeared that most of the differences existed because the computer positions were recorded before the track modifications were made. In one instance, the position as used by the computer was in error by one degree of latitude; this was most likely due to a recording error.

In this area of great anomaly differences, the WANDANK was forced to follow a modified track because of sea conditions. An examination of the chart used for plotting the ship's position as determined by celestial means revealed that the ship was constantly being set to the south. This

was to be expected as a result of the swell running from the northeast. It did not appear that the ship's navigator made a complete track adjustment for this set, but merely plotted each celestial position and projected the ship's travel ahead from this position without anticipating any future set. No track adjustment was made based on this conjecture, however. Substantiating this belief was the fact that at one crossing of its own track by WANDANK in this area, successive depth measurements were not in agreement.

Eötvös Correction

Equation (1) served as the basis for making the Eötvös correction to the observed gravity. This was recognized as possibly the greatest source of error because of the effect of ship's speed, and the manner in which the east-west component of speed as determined by Rose (personal communication) was examined. Instead of calculating this component at each gravity station from ship's heading and speed, it was "picked" from the chart directly. An examination of equation (1) revealed that at the equator, with the ship on an easterly or westerly heading, a one knot error in speed would result in an error in anomalies of about 7.5 milligals. At the suggestion of Rose, this east-west component was determined in a different manner. A separate computer program was written to compute the east-west speed component at each station by the solution of the equation:

$$(7) S_{EW} = S \sin \alpha$$

where S_{EW} is the east-west component of speed, S the ship's speed, and α the ship's heading. This was first done only for the area in which the greatest differences occurred, but this procedure was later followed for all gravity stations. In the area under discussion, the difference between the two methods of determining this component ranged from the triangular method being 1.7 knots greater to 2.5 knots less than the "pick" method. The majority of differences were $\pm .1$ to $.3$ knots.

When the new east-west components of speed and the corrected navigational positions were added to the main gravity program, the free-air anomalies at fifteen gravity stations changed by three to twelve milligals with the average change being an increase of seven milligals. Two stations had more negative free-air anomalies by 68 and 83 milligals; twelve stations had less negative anomalies by fifteen to twenty milligals with the average change being about seventeen milligals. The remainder of the 104 gravity stations in this region showed no change or a change of one milligal. Of the two biggest changes, one was due to both navigational and Eötvös correction changes, and the other was due to a change in the Eötvös correction alone. The remainder of the anomalies that changed appreciably had only slight navigational changes; most of the change was due to changes in the Eötvös correction. Table I shows some of the changes

which resulted.

The Appendix gives the results of the data reduction for the entire Solomons region, with those anomalies and navigational positions found to be in error, corrected.

Bathymetry

Erroneous bathymetry will not produce errors in the free-air anomaly, but it could introduce errors in the Bouguer anomaly as seen in equation (6) where d represents depth. There was one WANDANK track crossing where the bathymetry on successive crossings did not agree (see page 44). When steaming in a westerly direction on the 13th of November, the ship measured a depth of 5956 meters at 0730 and a depth of 5377 meters at 0745; the ship passed through the "crossing position" at 0738 in the morning. When passing through the same position at 1600 of the same day, a depth of 4400 meters was observed. This fact, along with the southerly set during the period of 12-14 November, strongly indicated the need for some track adjustment in this area. The bathymetry information obtained by the WANDANK was found to be in general agreement with all the bathymetry of the area which had been made available to the Hawaii Institute of Geophysics (personal communication with Rose). No gravity readings were obtained at either time of crossing on the 13th, so no conclusions were drawn about the accuracy of the point of crossing.

TABLE I
ANOMALIES BEFORE AND AFTER NEW EÖTVÖS CORRECTION
AND NAVIGATIONAL MODIFICATIONS MADE

| Latitude | Longitude | Free-Air Anomaly | | | Bouguer Anomaly | | |
|----------|-----------|------------------|------|---------|-----------------|-----|---------|
| | | Old | New | New-Old | Old | New | New-Old |
| 10-56.2S | 164-11.8E | -66 | -69 | -3 | 297 | 295 | -2 |
| 10-56.9S | 164- 9.9E | -60 | -56 | 4 | 313 | 317 | 4 |
| 10-58.9S | 164- 8.7E | -59 | -55 | 4 | 336 | 340 | 4 |
| 11- 0.9S | 164- 7.5E | -50 | -47 | 3 | 362 | 365 | 3 |
| 11- 3.0S | 164- 6.3E | -41 | -37 | 4 | 372 | 375 | 3 |
| 11- 4.7S | 164- 5.1E | -36 | -33 | 3 | 357 | 360 | 3 |
| 11- 5.3S | 163-59.1E | -54 | -55 | -1 | 341 | 341 | 0 |
| 11- 3.9S | 163-53.1E | -63 | -52 | 11 | 361 | 373 | 12 |
| 11- 5.7S | 163-50.9E | -58 | -46 | 12 | 367 | 378 | 11 |
| 11- 7.7S | 163-48.7E | -54 | -43 | 11 | 372 | 384 | 12 |
| 11- 9.2S | 163-47.2E | -41 | -30 | 11 | 358 | 370 | 12 |
| 11-10.3S | 163-45.0E | -36 | -24 | 12 | 336 | 348 | 12 |
| 11-20.8S | 162-52.7E | -148 | -141 | 7 | 362 | 369 | 7 |
| 11-22.2S | 162-51.8E | -115 | -108 | 7 | 365 | 371 | 6 |
| 10-48.5S | 161-17.5E | -16 | -84 | -68 | 336 | 268 | -68 |
| 11-20.3S | 161-14.2E | -15 | 2 | 17 | 337 | 355 | 18 |
| 11-18.6S | 161-11.7E | -15 | 2 | 17 | 326 | 344 | 18 |
| 11-17.7S | 161-10.1E | -16 | 1 | 17 | 325 | 343 | 18 |
| 11-16.8S | 161- 8.5E | -19 | -1 | 18 | 287 | 305 | 18 |
| 11-15.9S | 161- 6.9E | -17 | 0 | 17 | 302 | 320 | 18 |
| 11-15.0S | 161- 5.2E | -15 | 2 | 17 | 304 | 322 | 18 |
| 11-13.3S | 161- 1.1E | -16 | 1 | 17 | 307 | 325 | 18 |
| 11-12.4S | 160-58.5E | -23 | -5 | 18 | 290 | 309 | 19 |
| 11-11.5S | 160-56.0E | -19 | -1 | 18 | 303 | 321 | 18 |
| 11-10.6S | 160-53.7E | -19 | -31 | -12 | 299 | 287 | -12 |
| 11- 9.8S | 160-51.4E | -17 | -29 | -12 | 290 | 278 | -12 |
| 11- 8.9S | 160-49.1E | -18 | -31 | -13 | 295 | 283 | -12 |
| 11- 8.0S | 160-46.8E | -37 | -120 | -83 | 268 | 184 | -84 |
| 11- 6.0S | 160-47.9E | -26 | -25 | 1 | 243 | 245 | 2 |

Vertical Accelerations

Vertical accelerations of the measuring platform in excess of ± 50 gals, have been found to cause erroneous gravity readings. In this area, because of weather, the ship was forced to alter its proposed track in order to obtain gravity readings. Prior to 1965, when the stabilized platform was introduced by LaCoste and Romberg, their gravity meters were designed and adjusted to operate at horizontal and vertical accelerations of only ± 50 gals. According to LaCoste (1967), the horizontal acceleration limit of ± 50 gals was made in order to retain adequate accuracy in the analog computer for the Browne correction; it was not expected that the vertical accelerations would greatly exceed the horizontal accelerations. The meters could withstand vertical accelerations greater than this limit, but their linearity was not sufficiently well adjusted to make the errors small at accelerations greater than the ± 50 gals limit. Data was collected at such excess accelerations, and it is now possible to compute corrections to such data. In tests by Allan et al. (1962) on a 3000 ton ship, the LaCoste and Romberg meter S9 gave errors of about \pm two milligals in calm seas and ten to twenty-five milligals when the ship headed into a moderate sea. The errors of \pm two milligals were not surprising. Dehlinger and Yungul (1962) reported errors as high as forty-nine milligals using the same meter on a 250 ton ship. Dehlinger worked out an empirical

correction based on horizontal acceleration that reduced vertical acceleration errors to about \pm ten milligals. Harrison and LaCoste (1968) determined that large vertical accelerations accounted for most of the errors in the LaCoste and Romberg meters. Harrison, by applying corrections that he had obtained from a 1963 test with meter S9, reduced errors in data obtained from an experimental LaCoste and Romberg stabilized platform gravity meter in 1964 from a mean error of 8.4 milligals and rms errors that ranged from five to twenty milligals to a mean error of 1.1 milligals and rms error of 3.6 milligals. LaCoste made similar corrections to data from another meter with improvement; these corrections can be applied to other data using information available from LaCoste and pertaining to the meter which collected the data.

Rose (1967) applied vertical acceleration error corrections to the data obtained using the S9 on the DAMPIER. He noted that the corrections were generally less than + twenty milligals with some corrections of + fifty milligals and an occasional correction in excess of + 100 milligals. Vertical acceleration error corrections have not been made to the WANDANK data. It was planned to determine some of these corrections for the WANDANK data in hopes of finding some of the 150 milligal difference. This was not done, but an examination of the records in this area did not indicate that large vertical accelerations were present. The vertical

acceleration error, nevertheless, can be determined from:

$$(8) \Delta g = a(R_0 - R)[A_v]^2$$

$$(9) A_v = K[B_x]/T$$

where Δg is the vertical error in milligals; a is a constant for the meter in question as are R_0 , and K ; T is the period of beam motion in seconds; B_x is the division of beam motion where 100 divisions is maximum motion; A_v is the vertical acceleration in gals and R is the average position of the beam (correspondence with LaCoste).

3. CORRELATION OF WANDANK ANOMALIES WITH DEPTH AND LATITUDE

Figures 16 through 19 are identical in format with Figures 10 through 13 (pp. 36 - 39). The dotted line represents the least squares fit to the overall data. The gap that appears in Figures 16 and 18 for anomalies between 10 and 11 degrees exists because of the discontinuous collection of data in this area due to the weather. The least squares fit of Figure 16 shows a trend of decreasing free-air anomaly with increasing latitude. The scatter in this figure is not as great as that of Figure 10 (p. 36) which shows the correlation for the overall data. The linear trend of decreasing free-air anomaly with increasing depth is very evident in Figure 17; the trend is much more pronounced than that shown in Figure 11 (p. 37). A very marked increase in Bouguer anomaly with increasing latitude is shown in Figure 18. The random

scatter of Figure 12 (p. 38) is not present in this presentation. Figure 19 shows a stronger linear trend of increasing Bouguer anomaly with increasing depth than does Figure 13 (p. 39).

The values for the goodness of fit parameter (the standard deviation) in this area where large differences exist between 1964 and 1965 data were determined and compared with those obtained for the overall 1964 data. There were 104 gravity stations established in this area representing about 18 per cent of all the data collected by WANDANK. The goodness of fit was much better for this region than for the overall data. For the overall data, the values ranged from 105.2 to 62.2. In this area, the range was from 48.5 to 34.0. Table II shows the values for the overall area and for this particular area.

TABLE II
GOODNESS OF FIT PARAMETER COMPARISON

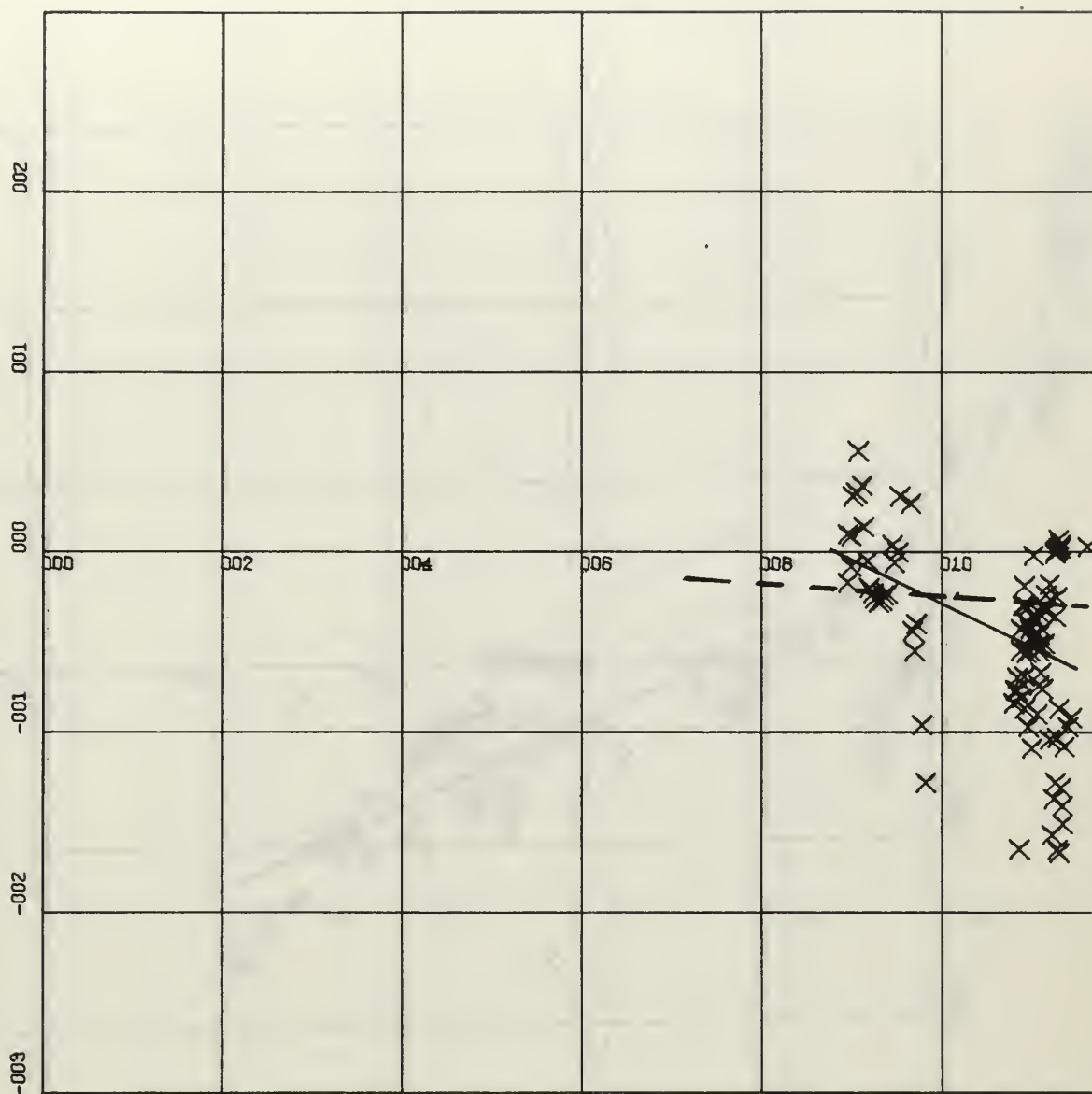
| | Overall | Area of Differences |
|------------------|-----------|---------------------|
| Free-air Anomaly | | |
| vs. Latitude | 74.97592 | 45.41911 |
| vs. Depth | 62.25532 | 33.98317 |
| Bouguer Anomaly | | |
| vs. Latitude | 105.17833 | 48.47650 |
| vs. Depth | 62.47371 | 34.17099 |

Figures 20 and 21 (pp. 57-58) show the Hollerith field printout for part of this difference area. In general, the Bouguer anomaly decreased with decreasing depth and the free-air anomaly became less negative and even positive with this

depth change. The data plotted in Figure 21 beyond 1200 on the 14th was outside the region under consideration, but prior to 1200, the data presented showed these trends better than did that of Figure 20. The trends displayed are the same as those of Figures 5 and 6 (pp.30 -31) which presented data representative of the entire cruise. They do differ from the trends of Figure 7 (p.32) which showed a nearly constant value for the Bouguer anomaly when depth was increasing as well as decreasing.

4. CROSSINGS OF WANDANK AND DAMPIER TRACKS

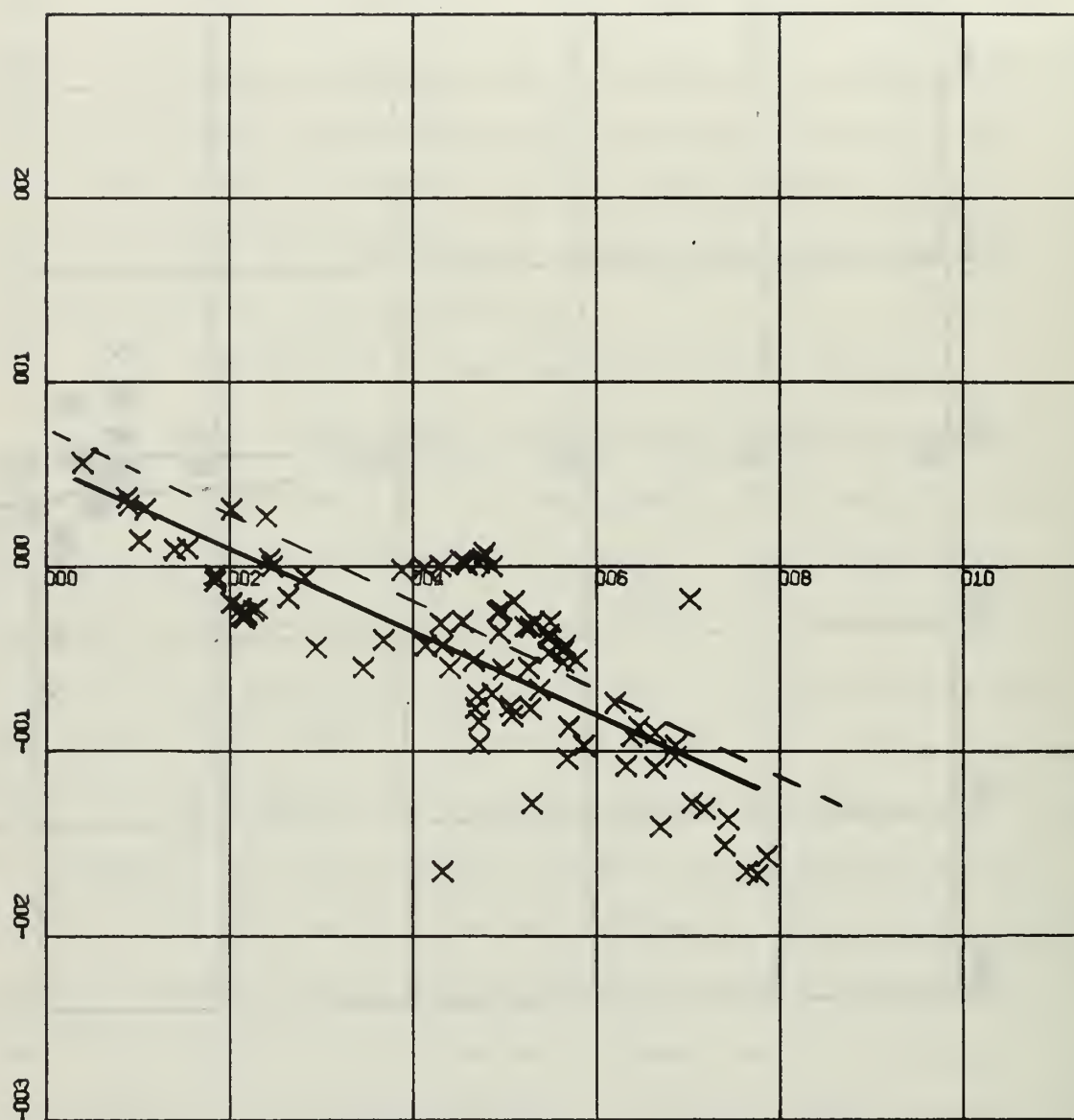
The Hawaii Institute of Geophysics investigators felt that the WANDANK data in this area produced anomalies which were too large by about 150 milligals. Figure 22, which shows the only section in which DAMPIER and WANDANK tracks came within thirty miles of each other in this area, shows one reason for reaching this conclusion. At each data point shown in the figure, the negative number represents the free-air anomaly, and the positive number represents the Bouguer anomaly. In the section to the northeast, data points within one and one-half miles of each other show a difference of twelve milligals in the free-air anomaly and thirty-one milligals in the Bouguer anomaly. The next data points plotted for each ship are three and one-half miles apart and show a difference of seventy-three milligals in the free-air anomaly and twenty-two milligals in the Bouguer anomaly. These differences are not as upsetting as data points further



X-SCALE=2.00E+00 UNITS INCH.

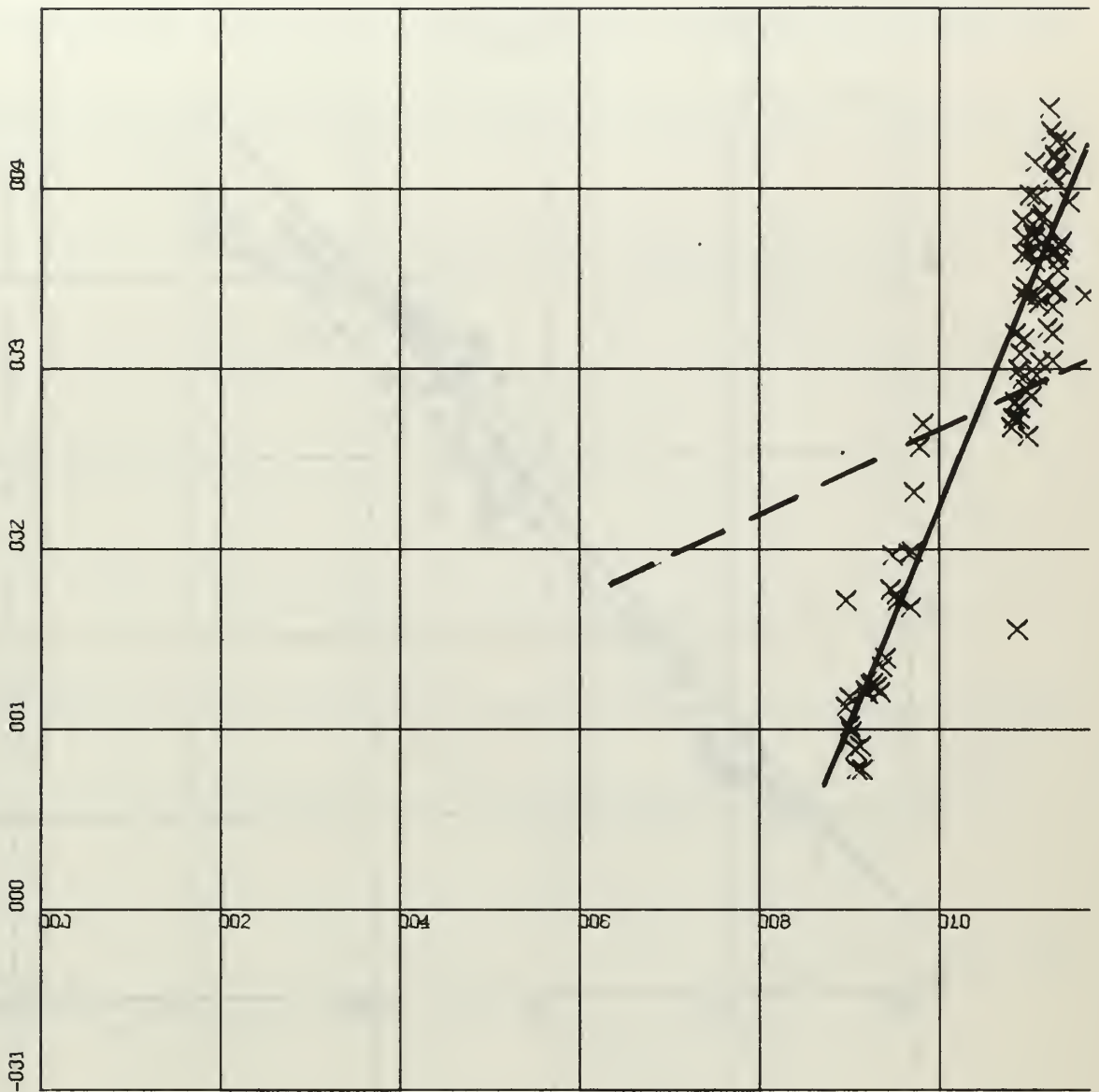
Y-SCALE=1.00E+02 UNITS INCH.

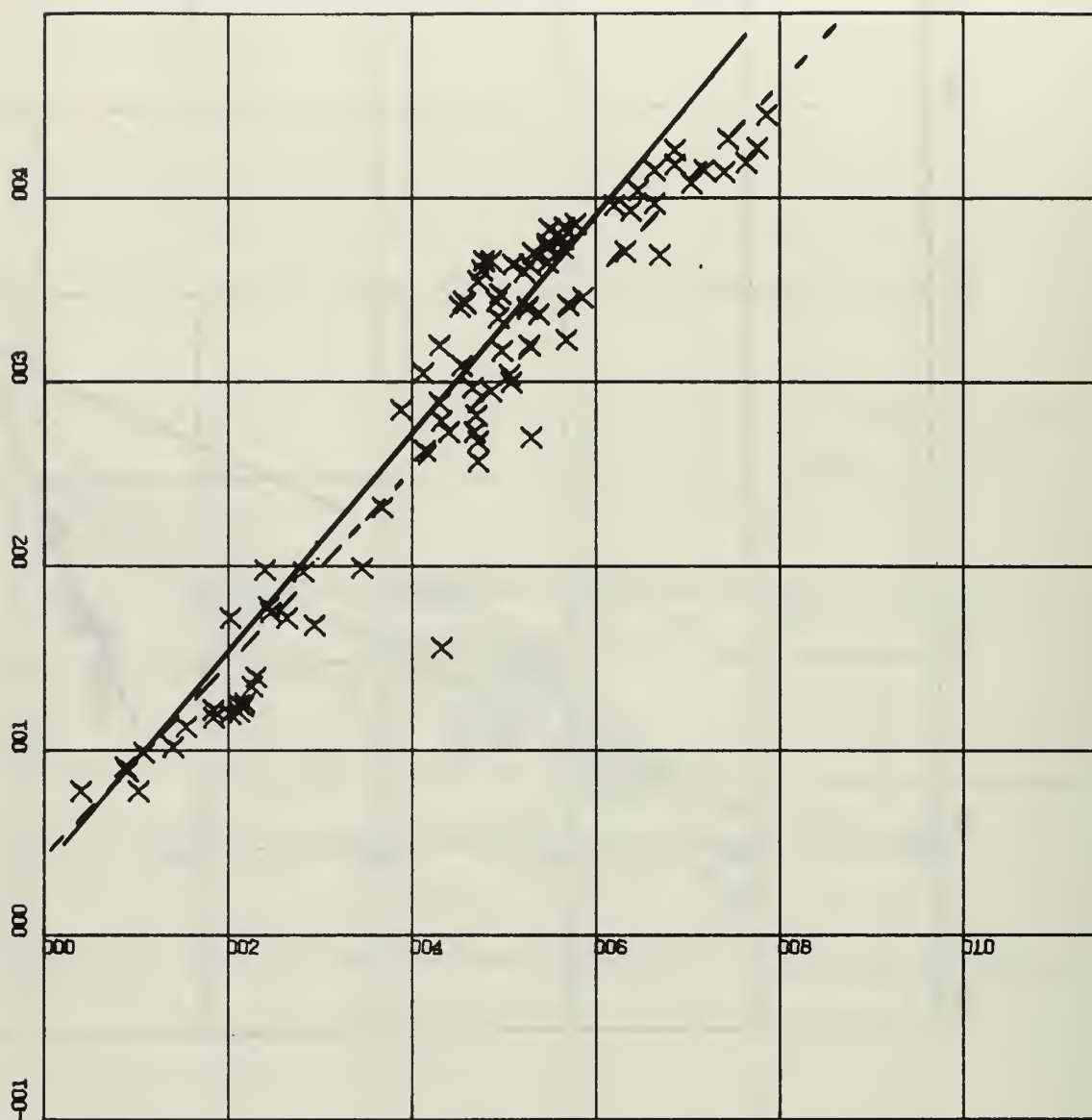
Fig. 16. Free-air anomaly(Y-axis) vs. south latitude(X-axis) for area of differences in Solomons, 1964.



X-SCALE=2.00E+03 UNITS INCH.
Y-SCALE=1.00E+02 UNITS INCH.

Fig. 17. Free-air anomaly(Y-axis) vs. depth in meters(X-axis)
for area of differences in Solomons, 1964.





X-SCALE=2.00E+03 UNITS INCH.

Y-SCALE=1.00E+02 UNITS INCH.

Fig. 10. Bouguer anomaly(Y-axis) vs. depth in meters(X-axis)
for area of differences in Solomons, 1964)

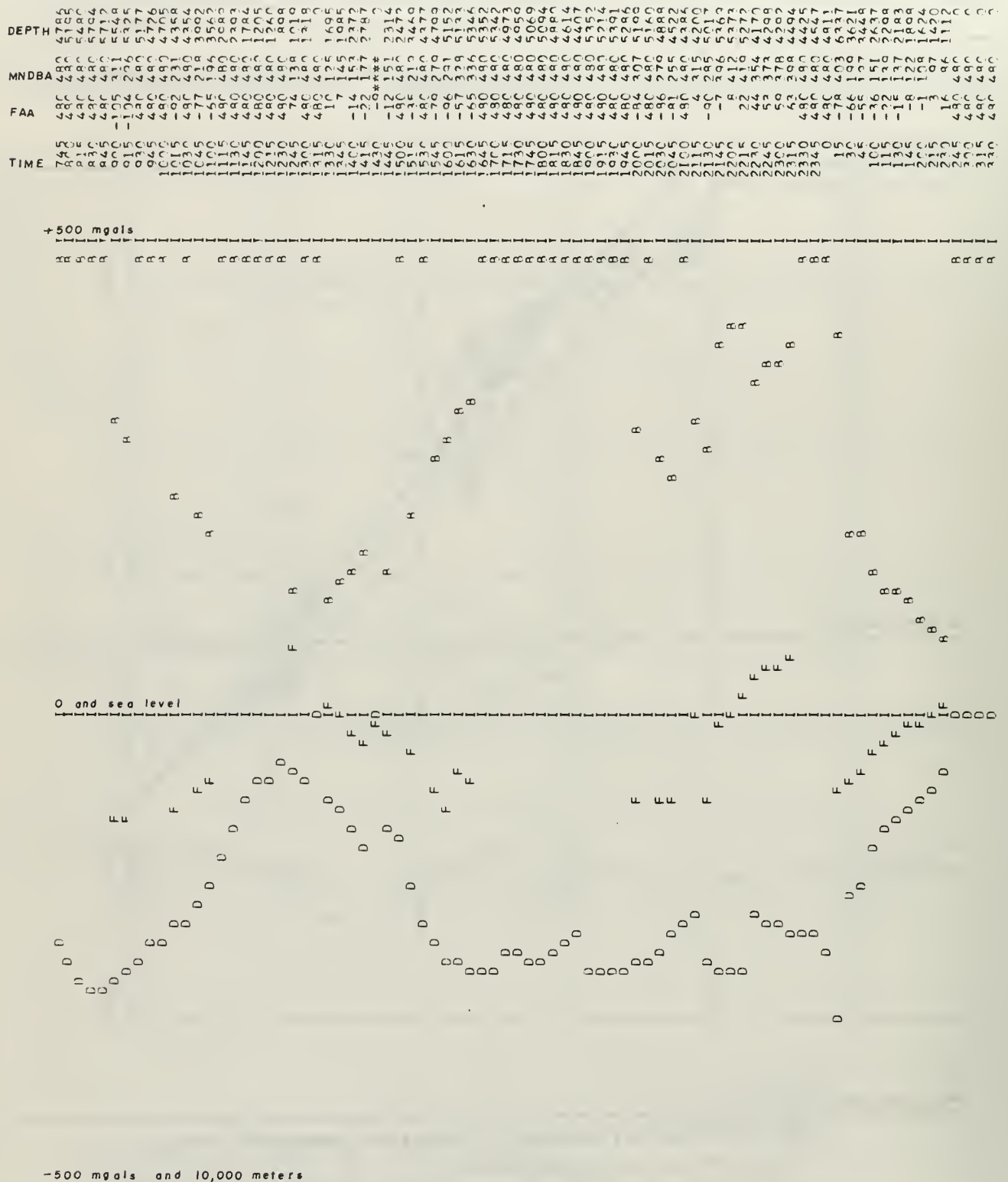


Fig. 21. Free-air anomaly(F), Bouguer anomaly(B), and depth(D) on 14-15 Nov 1964.

to the west where within three miles of each other, data points reveal the WANDANK free-air anomaly to be high by fifty-three milligals and the Bouguer anomaly to be 132 milligals higher than the DAMPIER anomaly. Unfortunately, Bouguer anomalies were not available for data points closer together, but the free-air anomalies for DAMPIER much closer than three and one-half miles of WANDANK show that WANDANK anomalies were high by 120, 143, 148, and 168 milligals. The anomaly values shown for WANDANK are those obtained before changes were made in navigational position and Eötvös correction. The new values for the data points discussed above differ from those plotted by at most three milligals.

5. CORRELATION OF DAMPIER ANOMALIES WITH DEPTH AND LATITUDE

For comparison, a least squares fit to the gravity anomalies and latitude and depth was determined for the fifty-seven DAMPIER data points in this area for which both anomalies and depth were available. Table III shows the standard deviations for a linear fit to the anomalies obtained in this area by WANDANK and DAMPIER. The large differences in the standard deviation for the anomalies of the two ships in this area may be directly related to the fact that 104 data points were available for WANDANK and only 57 points for the DAMPIER.

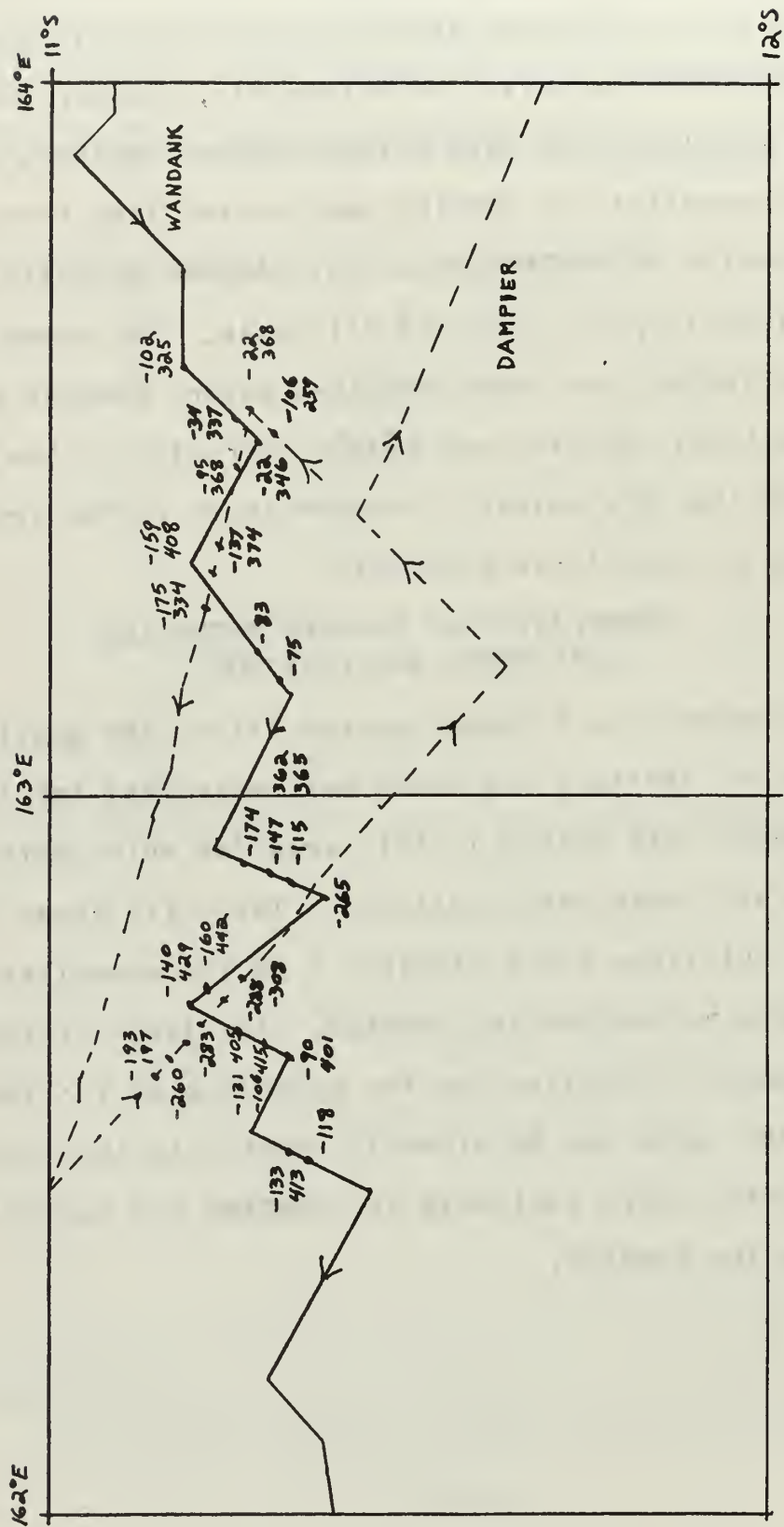


Fig. 22. WANDANK and DAMPIER tracks in area of anomaly differences.

TABLE III
STANDARD DEVIATIONS FOR WANDANK AND DAMPIER
ANOMALIES IN DIFFERENCE AREA

| | WANDANK | DAMPIER |
|------------------|-----------|-----------|
| Free-air Anomaly | | |
| vs. Latitude | 45.419119 | 75.376572 |
| vs. Depth | 33.983170 | 52.614212 |
| Bouguer Anomaly | | |
| vs. Latitude | 48.476501 | 67.432800 |
| vs. Depth | 34.170990 | 57.533295 |

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

It was hoped that an examination of the gravity anomalies resulting from data collected by the WANDANK would either reveal a source or sources of error in the data or show conclusively that no errors existed. It did neither. A change in procedure for calculating the east-west component of speed for use in the Eötvös correction, and the correction of navigational positions of the gravity stations as they appeared in the gravity data reduction computer program produced some marked changes in the anomalies, but not in the area where these anomalies appeared to be high by about 150 milligals. The exact positions of each gravity station in this area of differences are in doubt because of the uncertainty of how the problem of the set of the ship was incorporated in the final navigational track constructed, and because of differences in measured depth when the WANDANK crossed its own track in this area. Although the question of what magnitude of error could be attributed to vertical accelerations has not been quantitatively answered, it does appear that they are not the main source of the differences. Bathymetry was eliminated as a source of large error as this is in general agreement with other data collected in the area.

Conclusions

After considering the possible errors in WANDANK's

navigation, the sea conditions under which the ship was collecting data, and the experience gained on the WANDANK cruise that was available when collecting data aboard the DAMPIER, it was agreed that the most suspect anomalies were those resulting from WANDANK data. The exact cause of the anomaly differences was not found.

Several approaches are left which might lead to some improvement in the anomalies. After a detailed bathymetry chart of the area has been published, it might be possible to adjust the WANDANK track and recompute the anomalies. Such an approach must consider the fact that much of the data used in producing such a chart will be that collected by WANDANK. Coupled with a quantitative examination of the gravity meter records with respect to vertical accelerations, this should produce some improvement in the WANDANK anomalies. Another survey in this area would certainly be justified to settle the question of anomaly differences.

The remainder of the WANDANK data has been corrected. It is in general agreement with DAMPIER data, except for two relatively small areas where a twenty-five to thirty milligal difference exists, and can be used with some confidence as to its accuracy. In the area south of San Cristobal Island, the procedure used by Rose of subtracting 150 milligals from the WANDANK anomalies is recommended until resurvey of this area is accomplished.

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APPENDIX

[illegible]

| SEA GRAVITY REDUCTIONS FOR THE MANDANK SLOUGH TANK CRUISE NOVEMBER 1964 | | | | | | | | | |
|---|-----|-----|------|---------------------|----------------------|--------|----------|-------------|---------------|
| CARD | NO | DAY | HOUR | LATITUDE DEG MIN | LONGITUDE DEG MIN | REF C | THEORY C | FAA MGAU | DEPTH MGAU |
| 647 | NOV | 7 | 330 | 0 0.0 | 0 0.0 | | | 3010 | |
| 648 | NOV | 7 | 345 | 0 0.0 | 0 0.0 | | | 3026 | |
| 649 | NOV | 7 | 400 | 4 53.0 S | 154 13.0 E | | | 3026 | |
| 650 | NOV | 7 | 415 | 0 0.0 | 0 0.0 | | | 3030 | |
| 651 | NOV | 7 | 430 | 0 0.0 | 0 0.0 | | | 3037 | |
| 652 | NOV | 7 | 445 | 0 0.0 | 0 0.0 | | | 3060 | |
| 653 | NOV | 7 | 500 | 0 0.0 | 0 0.0 | | | 3344 | |
| 654 | NOV | 7 | 515 | 0 0.0 | 0 0.0 | | | 3358 | |
| 655 | NOV | 7 | 530 | 0 0.0 | 0 0.0 | | | 324 | |
| 656 | NOV | 7 | 545 | 0 0.0 | 0 0.0 | | | 300 | |
| 657 | NOV | 7 | 550 | 4 53.0 S | 154 22.0 E | | | 713 | |
| 658 | NOV | 7 | 515 | 0 0.0 | 0 0.0 | | | 602 | |
| 659 | NOV | 7 | 530 | 0 0.0 | 0 0.0 | | | 780 | |
| 660 | NOV | 7 | 645 | 0 0.0 | 0 0.0 | | | 511 | |
| 661 | NOV | 7 | 700 | 0 0.0 | 0 0.0 | | | 1881 | |
| 662 | NOV | 7 | 715 | 0 0.0 | 0 0.0 | | | 2200 | |
| 663 | NOV | 7 | 730 | 0 0.0 | 0 0.0 | | | 2300 | |
| 664 | NOV | 7 | 745 | 0 0.0 | 0 0.0 | | | 2234 | |
| 665 | NOV | 7 | 800 | 4 55.0 S | 154 52.0 E | | | 2294 | |
| 666 | NOV | 7 | 815 | 0 0.0 | 0 0.0 | | | 0 | |
| 667 | NOV | 7 | 830 | 0 0.0 | 0 0.0 | | | 303 | |
| 668 | NOV | 7 | 845 | 0 0.0 | 0 0.0 | | | 3010 | |
| 669 | NOV | 7 | 900 | 0 0.0 | 0 0.0 | | | 3130 | |
| 670 | NOV | 7 | 915 | 0 0.0 | 0 0.0 | | | 3150 | |
| 671 | NOV | 7 | 930 | 0 0.0 | 0 0.0 | | | 0 | |
| 672 | NOV | 7 | 945 | 0 0.0 | 0 0.0 | | | 0 | |
| 673 | NOV | 7 | 1000 | 0 0.0 | 0 0.0 | | | 0 | |
| 674 | NOV | 7 | 1015 | 0 0.0 | 0 0.0 | | | 0 | |
| 675 | NOV | 7 | 1030 | 0 0.0 | 0 0.0 | | | 0 | |
| 676 | NOV | 7 | 1045 | 4 56.2 S | 155 10.8 E | 078107 | 078107 | 19 | |
| 677 | NOV | 7 | 1100 | 4 56.0 S | 155 22.5 E | 078105 | 078107 | 18 | |
| 678 | NOV | 7 | 1115 | 4 56.4 S | 155 25.0 E | 078113 | 078107 | 26 | |
| 679 | NOV | 7 | 1130 | 4 56.4 S | 155 27.3 E | 078110 | 078107 | 53 | |
| 680 | NOV | 7 | 1145 | 4 56.8 S | 155 29.8 E | 078115 | 078107 | 60 | |
| 681 | NOV | 7 | 1200 | 4 57.0 S | 155 32.5 E | 078117 | 078107 | 86 | |
| 682 | NOV | 7 | 1215 | 4 57.2 S | 155 35.0 E | 078118 | 078107 | 81 | |
| 683 | NOV | 7 | 1230 | 4 57.4 S | 155 37.8 E | 078117 | 078107 | 01 | |
| 684 | NOV | 7 | 1245 | 4 57.6 S | 155 40.1 E | 078103 | 078107 | 105 | |

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| 13. ABSTRACT In 1964 a reconnaissance marine gravity survey was conducted in the Solomon Islands by the Hawaii Institute of Geophysics, University of Hawaii. In 1965, a more detailed survey was conducted in the same area by the same investigators. In one particular area of the survey, gravity anomalies obtained in 1964 differed from those obtained in 1965 by as much as 168 milligals. In other areas where differences did occur, these were on the order of 25 milligals. This thesis reports the investigation carried out to determine the reason or reasons for the large discrepancies. Navigational positions were checked; the bathymetry obtained in 1964 was compared with other bathymetry available; the Eötvös correction was recalculated with the corrected station position and better resolution; and the gravity records were examined to determine if large vertical accelerations of the measuring platform could be the cause of the discrepancies. Some errors were discovered, but the large differences could not be eliminated. |
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Eötvös correction

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